

telephony

INTERNATIONAL ISSUE

JANUARY 24, 1983

C8700-1 1/25/83

THE JOURNAL OF TELECOMMUNICATIONS SINCE 1901

TOP NEWS: MCI's \$1.8 billion award reversed in AT&T suit, p.11
AT&T takes first step towards international data market, p.12
Ericsson's new plan eyes liberalized market, p.14

Cover: Exclusive interview with Richard Butler, the ITU's new top exec, p.28;
plus features from Hong Kong, Israel, France, the United States and Japan. . .

TY
MD20814CONGLIKENYJ FCG822341C
J KENNEDY SRI
CONGRESSIONAL INFORMATION SERV
STE 800
4520 EA WEST HIGHWAY
BETHESDA MD 20814

BEST AVAILABLE COPY

January 24, 1983

VOLUME 204
No. 4

telephony

News of the Week 11

Damages reversed in MCI antitrust suit against AT&T • Plessey, Scientific-Atlanta plan joint venture • Nigeria orders PBXs

36 A DQ system comes of age

An increase in directory enquiries prompted this telco to switch to a multiple minicomputer based directory assistance system
John Lee

AT&T to invade world data market 12
In the U.S. Capital: FCC seeks details on divestiture transfer • Washington Round-Up
Victor Block

42 Graphics in network planning

Graphic recording of network diagrams is a simple, cheap, fast way to improve network planning and maintenance
Ariana Cooper

Ericsson plots a new marketing course 14
European Liberalization: Racial consortium wins cellular radio license
R.J. Raggett

44 Sizing up Teletel videotex service

An extensive test trial of the Teletel videotex service revealed interesting data on how people use videotex services

What's in a name? 27
As We See It: Though our name is 82 years-old, there is no generation gap in the way TELEPHONY covers the telecom industry

56 Telephone cost of service studies

Here's a fundamental method for telco managers to use in judging the price and marketing of telecom services
Stuart McDaniel and Eric Smith

COVER STORY: Butler interview 28

An exclusive interview with Richard Butler, new secretary of the ITU, by R.J. Raggett, TELEPHONY's executive editor-international

62 Communications Tokyo '83

A preview of Communications Tokyo, where international manufacturers can show their telecom products for the first time
Michelle Greenberg

DEPARTMENTS

Advertisers' Index 96
European Liberalization 14
In the U.S. Capital 12
Meetings 9
Merits & Milestone 98

84 Moving Around Industry
67 New Products and Services
11 News of the Week
64 Plant Man's Notebook
25 Reader Service Card

Published by TELEPHONY PUBLISHING CORP.,
55 E. Jackson, Chicago, IL 60604
Telephone 312/922-2435; TWX 910 221 1058

European Bureau, 136 Broomfield Rd.,
Chelmsford, Essex CM1 1RN, England;
Telephone Chelmsford (0245) 58257;
Telex 995801 GLOTLX-G.

TELEPHONY (ISSN 0040-2656/83-0+\$1.50) is published weekly (except twice weekly during the second week of August and three times during the month of December) by Telephony Publishing Corp. Officers of Telephony Publishing Corp. are Dan S. Fargo, President; Leo Anderson, Del Myers and Ed Robinson, Vice Presidents. Postmaster: Please send form 3579 to Subscription Dept., TELEPHONY, 55 E. Jackson Blvd., Chicago, IL 60604. Second class postage paid at Chicago, Ill., and at additional mailing offices. Single copies (payable in advance) U.S. \$3.00 ea., issues over 2 years old \$3.50 ea. Outside U.S. add \$1.00 ea. Subscriptions: \$29 one year. Outside U.S. add \$20 per year. Subscription rates apply to employees of operating telephone companies; telephone consultants; contractors; interconnect companies; specialized common carriers; mili-

tary government associations; private communications users; schools; libraries. All others \$35 one year. Outside U.S. add \$20 per year. Change of address: include old address as well as new address. Attach issue label if possible. Allow 4 weeks for change to become effective. Copyright 1983 by Telephony Publishing Corp. Permission to photocopy for internal or personal use or the internal or personal use of specific clients is granted by Telephony Publishing Corp. for libraries and other users registered with the Copyright Clearance Center (CCC) provided that the fee of \$1.50 per page is paid directly to CCC, 21 Congress St., Salem, MA 01970. Special requests should be addressed to Telephony Publishing Corp.

French market trial yields usage statistics

Videotex services have become increasingly sophisticated and, not coincidentally, increasingly attractive to users. France has been particularly active in the field. This article takes a look at the latest videotex news from France and pays particular attention to hard data on usage patterns which have recently become available. The article was adapted from material that appeared in the December 1982 issue of Telematique News, published by Intelmatique, Paris, France.

SINCE ITS INCEPTION as a market experiment nearly 2 years ago, the Teletel 3V (T3V) videotex trial has grown sharply from an initial base of 84 different services in January 1981 to 190 today. There are 165 French companies participating.

During this growth, the managers of the trial discovered the need to re-define some of the terms that had sprung up with the advent of videotex.

"Information providers" was one of those terms.

"It had outlived its usefulness," said Georges Nahon, marketing director for Intelmatique. "We substituted the phrase 'service provider' because it better defined how all types of businesses contributed to the system.

"Home banking and shopping, and the ability to make transportation and hotel reservations from your

terminal are genuine services.

"Even those businesses whose chief product is information—the daily press, radio and TV, for instance—are also providing an important service."

More than 100,000 frames of information are currently available through the Velizy computer center, 60,000 of them at the center itself, and an additional 40,000 to 50,000 at remote databases. In addition, the execution services available probably account for millions of additional pages.

Twenty-four remote computers are connected to the Velizy center through a *distributed gateway*; eleven through TRANSPAC, the national packet switching network; and 13 through leased lines. All use the X.25 protocol.

The remote computers are of eight different kinds; Logabox, IBM, Hewlett Packard, Mitra (SEMS-THOMPSON), DEC, Data General, CII-Honeywell Bull (HB66) and Honeywell DPS6.

Six Honeywell DPS6 computers are located at the Velizy center.

Operators of the 24 remote computers maintain their own databases, and create and delete pages as they wish.

Editing terminals being used are X-COM, UNITEL and FIET. Each terminal includes an editing keyboard, a decoder and a floppy disk controller. Generally, service providers have

Continued on page 48

(Percentage of usage out of each 100 calls)

	No. of services	June 1982	Oct. 1982
Groceries, Food Industry	6	2.7%	1.5%
Insurance Companies	14	1.6%	0.7%
Car Industry/Motorcycles	4	2.3%	1.5%
Financial Companies/Stock Exchange/Banks	14	9.0%	8.2%
Retail (non-transactional)	19	2.4%	2.4%
Mail Order (transactional)	3	2.9%	1.6%
Energy Saving (oil company sponsors)	6	0.4%	0.2%
Market Studies (videotex advice, consultants) ..	8	0.4%	0.2%
Real Estate/Appliances	6	0.6%	1.0%
Home Entertainment (games, quizzes)	4	2.3%	2.6%
Press/Entertainment Guide/Radio-T.V.	25	27.1%	29.7%
*Local Administrations	10	1.4%	1.5%
*Administrations	25	2.1%	2.4%
Transportation/Tourism/Travel	19	8.2%	6.7%
Education	10	4.4%	3.4%
Others	10	0.5%	0.4%
Teletel Index/Instructions/Daily Highlights	6	21.6%	28.1%
Mail Service	1	10.0%	7.9%
	190	100.0%	100.0%

*Local and National Directory of Services and Departments

FIG. 1 The breakdown of calls by the business sector.

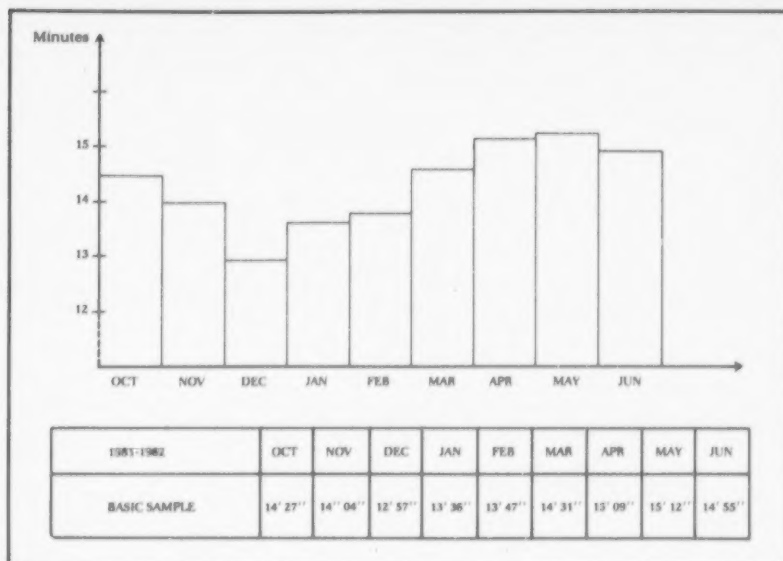


FIG. 2 Average duration of a call.

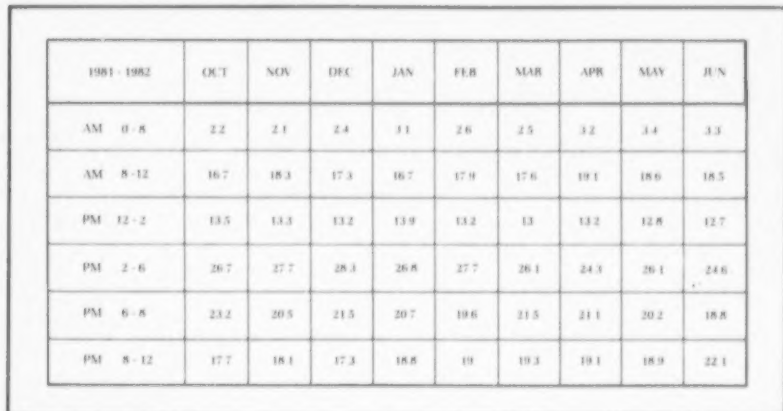


FIG. 3 Teletel calls per hour.

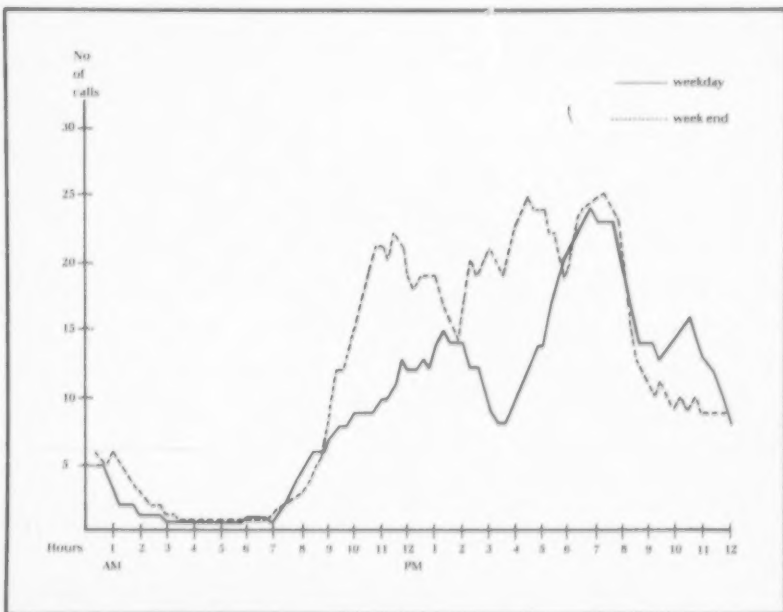


FIG. 4 Average daily videotex traffic.

the option of adding a camera, a digital tablet and a light pen. The terminal works either on line or off line (with storage on floppy disk).

For service providers that require frequent page replacement on a daily or weekly basis, an automatic system is in operation which electronically connects to, and creates videotex pages from, the material going to their printers.

This was especially necessary for JEF (Journal Electronique Francais), a consortium of news media, and for Parisien Libere, which provides the entertainment guide for France.

Hard data about videotex usage, of course, is important. Data collected during a 9-month period in a statistical study of the 2200 families involved in the T3V market trial are summarized in Figures 1 through 4. Here are some important facts about videotex usage:

- The busiest hour of the day is around 6 p.m.
- Saturday is the busiest day, but Wednesday is a close second.
- Some of the factors that influence usage are age, career status and education.

Since October 1981, the videotex computer center operated by the national French telecom administration (PTT) at Velizy, a Paris suburb, has tracked every videotex call made in the test area. Analysis of the results is expected to help French authorities determine user acceptability of the transactional technology, as well as consumer needs.

The major objectives of the French videotex trial were to define and evaluate in real terms the different social, cultural, economic and technical effects of this new communications medium.

Experts in the PTT currently are studying the raw data and are expected to issue a complete, analytical report.

The study revealed some interesting data for the experts. For instance, an average of 3.6 service providers are accessed during each videotex connection. Videotex calls averaged 14.5 minutes each. Of the videotex homes, 63% used the system more often than once a week. The average cost to each videotex household was only 12.6 francs (less than \$2.00) per month by June 1982.

Although the larger the size of the family, the greater was the usage of videotex, there was no early indication that children would abuse the

Continued on page 52

system. However, high videotex usage on Wednesdays was explained by the presence of children in the household, because Wednesday is not a school day in France.

Heads of households were divided into seven socio-economic categories: professionals, craftsmen, senior executives, middle management executives, white-collar and blue-collar workers, and retirees.

According to the number of videotex calls made per month, and the frequency of usage, executives had the greatest need for information and used the service most frequently.

As for services, the undisputed leader was the database on news and entertainment information, which

also offered some video games and other popular items like a Chinese horoscope. Page charges for this database were introduced last May, with only a slight, and apparently temporary, drop in demand for the service. The charge is 2 centimes per page.

Electronic mail also proved to be one of the most popular services. Of the 3305 terminals installed for the trial (2241 in homes), 1875 users have subscribed for the service, known as M3V. It averages 1500 calls per week.

Common interest groups (CIGs) have been established within M3V so the service can be used as a bulletin board or newsletter. Each subscriber

is entitled to form up to nine different CIGs, with a maximum of 40 persons in each group. So far, 343 different groups have been formed in M3V.

Charges for M3V range from 50 centimes (about \$1.20 an hour) for writing or answering a message, or sending one of the 65 postcards available.

It costs nothing to subscribe or to create or modify a common interest group.

The flat rate charge for distributing a single message to a CIG is 3 francs, or about 42¢.

How these rather small fees can be collected in a profitable manner is a question that is now being studied in France. □

T3V analysis

ROY D. BRIGHT

THE FIRST USERS of T3V were connected during March and April of 1981. Twenty months later more than 3000 terminals are active, of which some 2200 households represent the research sample while the balance are in the hands of service providers, the PTT's Velizy team and other specialist interests.

As a market research tool, its primary function, the trial has now been terminated although the system continues to be available to existing participants.

From its inception in 1979, T3V was planned to be run on third party databases but, to meet strong local demand, the final configuration combined a central database (retrieval function) with the ability to switch the caller to distant third party databases such as mail order or banking centers. These databases were added during the second and third quarters of 1981 resulting in a wide variety of applications among the 24 remote centers. One of the last to be added was the M3V (electronic mailbox) service.

The 9-month period used for the trial commenced in October 1981—some time after the majority of households were first connected, thus allowing for decay in the novelty factor, which is observable in all videotex trials.

Conversely, however, the number of services available grew from fewer than 100 to nearly 190 during this period, thereby stimulating additional interest as the user population matured.

The incidence and pattern of usage needs a more refined analysis than the general arithmetical average can provide. Whereas the average user made between 6.2 and 8.0 calls per month, analysis of the heavy user (defined as a household making at least one access per week) shows a fairly constant activity of between 14.8 and 16.2 calls per month. Average connect time, on the other hand, was static at approximately 14.5 minutes for most users, while frames accessed per call were also regularly recorded at about 47 frames for the whole 9 months.

Within the household, the husband was the most frequent user with a total of nearly 45% of all calls to his credit. The wife accounted for around 15% while children over 18 added a further 12% to the total. School holidays distort not only the seasonal but also the weekly pattern.

Turning to popularity of services, press and publishing, which includes radio and TV, beats its nearest rival, financial and stock exchange information, by three calls to one when weighted by the percentage of services offered in each sector. Using this same measure, administration drops to 3.1% while travel and tourism increases to 12%.

One subject which tends to distort the table of popularity is the inclusion of the Teletel index and user magazine. Some users might use the index frames a number of times during one session if they chose not to use the keyboard facility. Thus its inclusion—though statistically sound—results in a dilution of the commercial ranking.

This and many other issues may be

debated but underlying this entire exercise is an encouraging sense of continuing development of consumer interest. The healthy vitality of the transactional and other execution services is illustrated by the electronic mail and bulletin board with 1875 registered users (out of the 3000 total terminal population) averaging almost one call per user per week which is remarkable for such a small sample population. Although the decoder was provided free of charge, users paid the local telephone charge (9¢ for the second and subsequent 5 minutes durations) plus frame charges, where required by the service providers, as well as further 9¢ per 5 minutes for message creation plus 8¢ for each message sent or filed.

To summarize, the prime objective of the T3V trial—which was to assess socio-economic and marketing, rather than technical, issues—has been achieved. These results seem to suggest that there is a viable mass-market opportunity for a well-rounded videotex service which combines the inherent capability to offer up-to-date information services with the added-value features of tele-shopping, tele-banking, reservation and other interactive services.

The long-term future of Teletel videotex will be the subject of close scrutiny in France in the coming months with two reports being submitted to the Parliament and the Senate respectively before a final decision is made, but most observers believe that these results, coupled with the growing momentum of the electronic directory projects, should lead to an affirmative decision. □

Roy D. Bright is Managing Director of Intelmatique.

INTERNATIONAL ISSUE

telephony

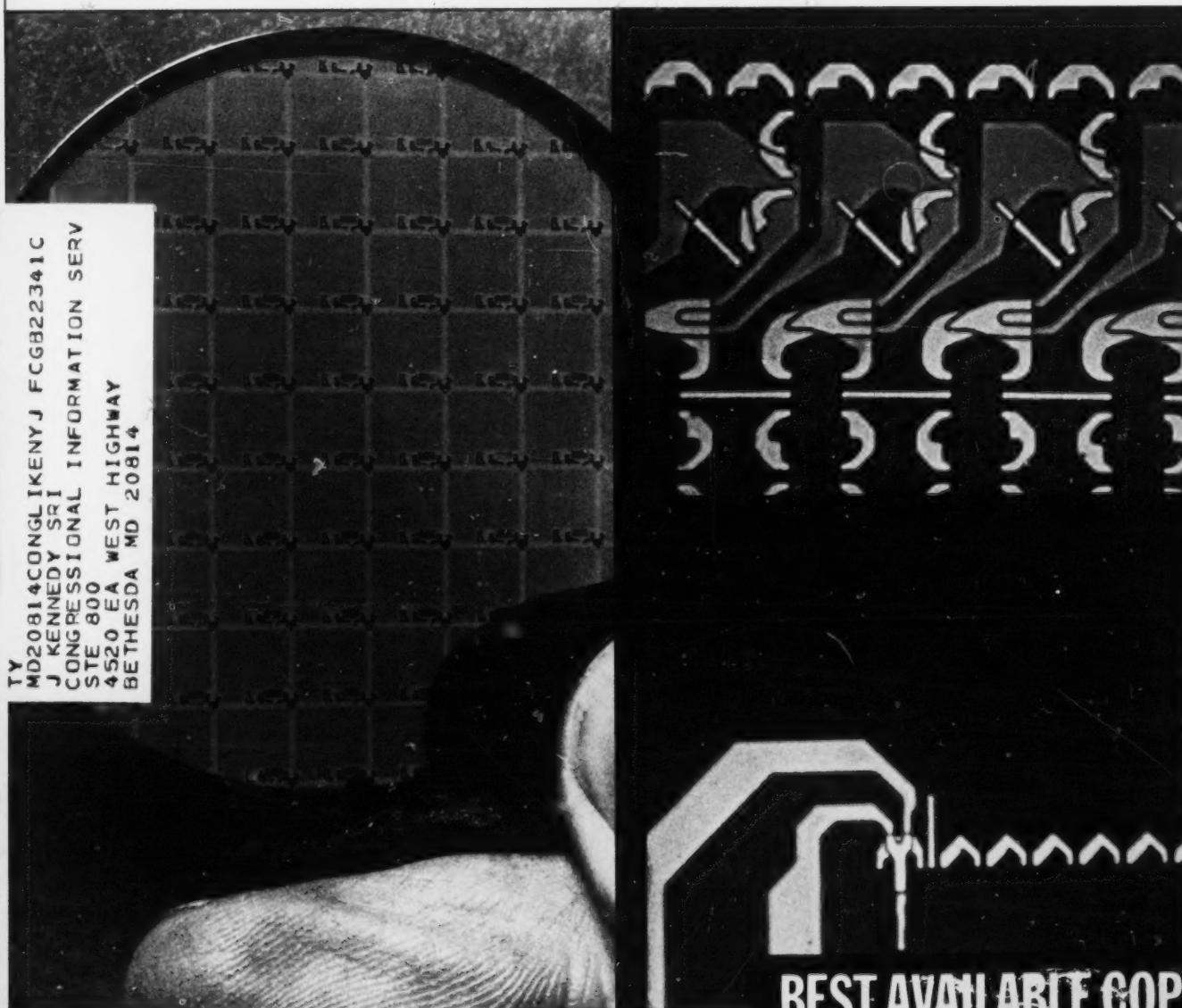
FEBRUARY 28, 1983

THE JOURNAL OF TELECOMMUNICATIONS SINCE 1901

TOP NEWS: Several groups attack AT&T divestiture plan, p.13
Plessey Office Systems unveils integrated switch, p.13
FCC launches inquiry and rulemaking on separations rules, p.16

Cover: A look at developments in magnetic bubble memory technology, p.34
Exclusive report: world telecom spending to top \$78 billion in 1983, p.39

TV
MD20814CONGLIKENYJ FCG822341C
J KENNEDY SRI
CONGRESSIONAL INFORMATION SERV
STE 800
4520 EA WEST HIGHWAY
BETHESDA MD 20814



BEST AVAILABLE COPY

February 28, 1983

VOLUME 204
No. 9

telephony

News of the Week 13

AT&T reorganization comes under sharp attack • Plessey launches switching system
• AT&T names Campanella marketing head

39 World telecommunications spending

The figures reveal that world telecom development is still uneven and business communications systems in commercial centers are on top
Del Myers, Janice Drummond and Czatdana Inan

FCC moves forward on separation rules 16

In the U.S. Capital: FCC takes action on land mobile channels • Washington Round-Up
Victor Block

48 PTC juggles economic, political issues

Pacific Telecommunications Conference 83 focused on the diverse factors affecting telecom network growth in the Pacific region
Del Myers

A good way to start 33

As We See It: The Executive Seminar on Communication Technology and Policy will help solve the international problem of uneven world telecom development

52 Comunicaciones Expo 83

Comunicaciones Expo 83 is set for April, where a new program, short courses and exhibits will focus on Latin America communications

COVER STORY: Bubble technology 34

After years of research and development, modern magnetic bubble memory technology is proving more reliable for use in digital phone systems
Norman Williams

56 Telco construction program boosts access lines

Plant Man's Notebook: General Telephone Co. of Florida enhanced security procedures helped increase nuisance calls arrests and convictions
Ray Blain

DEPARTMENTS

Advertisers' Index 110
In the U.S. Capital 16
Meetings 11
Merits & Milestones 112

96 Moving Around Industry
58 New Products and Services
13 News of the Week
56 Plant Man's Notebook

Published by TELEPHONY PUBLISHING CORP.,
55 E. Jackson, Chicago, IL 60604
Telephone 312/922-2435; TWX 910 221 1058

European Bureau, 136 Broomfield Rd.,
Chelmsford, Essex CM1 1RN, England;
Telephone Chelmsford (0245) 58257;
Telex 995801 GLOTLX-G.

TELEPHONY (ISSN 0040-2656/83-0 + \$1.50) is published weekly (except twice weekly during the second week of August and three times during the month of December) by Telephony Publishing Corp. Officers of Telephony Publishing Corp. are Dan S. Fargo, President; Leo Anderson, Del Myers and Ed Robinson, Vice Presidents. Postmaster: Please send form 3579 to Subscription Dept., TELEPHONY, 55 E. Jackson Blvd., Chicago, IL 60604. Second class postage paid at Chicago, Ill., and at additional mailing offices. Single copies (payable in advance) U.S. \$3.00 ea., issues over 2 years old \$3.50 ea. Outside U.S. add \$1.00 ea. Subscriptions: \$29 one year. Outside U.S. add \$20 per year. Subscription rates apply to employees of operating telephone companies; telephone consultants; contractors; interconnect companies; specialized common carriers; mili-

tary government associations; private communications users; schools; libraries. All others \$35 one year. Outside U.S. add \$20 per year. Change of address: include old address as well as new address. Attach issue label if possible. Allow 4 weeks for change to become effective. Copyright 1983 by Telephony Publishing Corp. Permission to photocopy for internal or personal use or the internal or personal use of specific clients is granted by Telephony Publishing Corp. for libraries and other users registered with the Copyright Clearance Center (CCC) provided that the fee of \$1.50 per page is paid directly to CCC, 21 Congress St., Salem, MA 01970. Special requests should be addressed to Telephony Publishing Corp.

World telecom spending to reach \$78.5 billion level this year

DEL MYERS, EDITOR,

JANICE DRUMMOND, TECHNICAL EDITORIAL DIRECTOR,
and CZATDANA INAN, DIRECTOR-MARKETING RESEARCH

TELEPHONY's 1983 Annual Survey of International Telecommunications is the primary source of the information in this article. This year's survey was expanded substantially over previous ones in recognition of the United Nations resolution declaring 1983 World Communications Year and designating the International Telecommunication Union (ITU) as the lead agency for the Year.

The survey, a 12-page questionnaire published in English, French and Spanish, was sent to a selected sample of national telecommunications administrations and companies throughout the world. The queries solicited information on planned spending and plant investment but concentrated on the elusive goal of quantifying the world's existing telecommunications plant. Reaching that goal requires a continuing effort and the cooperation of telecommunications authorities throughout the world.

Consequently, all of the information gathered in TELEPHONY's 1983 survey and in subsequent surveys will be made available to the ITU for use by its members in quantifying their networks and identifying colleagues for information exchange.—*Ed.*

WORLD telecommunications spending excluding the United States will reach \$49.7 billion in 1983. This estimate is based on a constant-dollar, weighted extrapolation of data received from 38 countries serving 64% of the world's 320 million non-U.S. telephones.

This estimate represents a 6% real increase over 1982 spending (\$46.9 billion in constant dollars), and the first significant increase since 1980 and 1981. Then, the constant-dollar

spending levels were \$45 billion and \$45.4 billion respectively.

World telecommunications spending, including figures for the United States (TELEPHONY, Jan. 10, p. 26), will reach a level of \$78.6 billion, an amount approximately equal to 17% of the world's total estimated \$453.4-billion investment in telecommunications plant.

The correlation between projected spending and total plant investment is very important because plant does

wear out. Merely maintaining the status quo requires substantial spending.

Spending projections, of course, provide a benchmark for measuring the fiscal health of the industry on a yearly basis. For the telecommunications administrations (PTTs) and companies, however, the composition of the installed plant is the bottom line against which all capital expenditures must be measured.

In many countries, the 1983 budget allocations closely follow the spending projections made in 1982. This indicates that these administrations are pushing hard and successfully against recessionary pressures to complete projects that were funded partially in previous budgets.

The composite plant statistics (Tables 1, 2, 3 and 4) are only a small part of the data collected in the survey, but they reveal a familiar picture—a world of telecommunications abundance contrasted with telecommunications scarcity.

The countries are grouped by zones based on the International Telephone World Number Zone Plan, guidelines of the International Telegraph & Telephone Consultative Committee (CCITT).

If total telephones versus population is the chosen measure of telecommunications development, Sweden currently leads the world with some 83 telephones per 100 inhabitants.

This measure is unrealistic, however, in many countries that still are developing their networks. There, the relation between the number of business main lines and the number of business establishments may be the best measure of both telecommunications development and its contribution to overall national development.

In industrialized nations, the number of modems, telex terminals, private branch exchanges (PBXs) and key systems is a measure of network sophistication and an indication of the change occurring in the country's economic base. Switzerland and Belgium, for example, are information-intensive societies, and each nation has a disproportionate share of business communications users with respect to Europe.

The changes in the world's economic base—from manufacturing to information in the industrialized nations; from agrarian to manufacturing in the industrializing nations—are well known. Table 1 reveals, how-

Continued on page 41

Table 1

Europe

(Data as of Jan. 1, 1982, unless otherwise indicated)

Zones 3 and 4	Total Telephones	Lines		Total Exch	Switches Under 5000 Lines	
		Equipped	In Service		Local	
Austria	3,177,944				1440	
Belgium	3,820,000	2,940,300	90%		553	70%
Channel Islands						
Jersey	52,658	40,876	81%		6	67%
Guernsey	37,070					
Cyprus	143,000	111,850	77%		31	87%
Denmark^a	3,316,708					
Jydsk Tel	1,287,722				697	95%
KLAS	1,780,000					
Finland	2,374,461					
Private		1,605,112	82%		1498	97%
PTT		711,000	74%		2226	99%+
France	24,686,319					
Germany	28,563,622	25,857,000	86%		6105	75%
Greece	2,796,435			3711		
Hungary	1,296,682			2505	2505	
Iceland	111,088			122		
Italy	20,450,000			10,019		
Ireland	715,000			1026		
Luxembourg	253,000	169,700	80%		43	81%
Malta	90,997					
Monaco	21,018					
Netherlands	7,230,000					
Norway	1,992,090	1,559,000	85%		3732	98%
Portugal^b	1,371,731					
TLP		834,450	86%		79	54%
PTT		1,331,337			843	99%
Spain	11,844,623				2447	89%
Sweden	6,620,500	6,031,000	81%		6034	98%
Switzerland	2,924,876	3,729,590	78%		1026	
United Kingdom	27,961,646					
Kingston upon Hull	177,646			14		
PTT	27,784,000	21,258,000	89%		6315	78%

a: Denmark has two other carriers, which account for the difference in the number of telephones.

b: Portugal has two communication public service companies: Post & Telecommunications of Portugal (CTT) and Telephones of Lisbon & OPORTO (TLP). Both have the same Administrative Council.

c: The United Kingdom has an additional 250,000 private (rented) payphones.

Table 2

Africa

AT&T Long Lines' publication, "The World's Telephones," shows a total of 5,028,177 telephones in Africa as of Jan. 1, 1981. Assuming 10% growth—the average growth exhibited by countries for which comparison could be made—there should have been 5,530,995 total telephones in Africa as of Jan. 1, 1982. The countries included in Table 2 for Africa represent 4,122,846, or 75%, of the continent's telephones. (Data as of Jan. 1, 1982, unless otherwise indicated)

Zone 2	Total Telephones	Lines		Total Exch	Switches Under 5000 Lines	
		Equipped	In Service		Local	
Ascension Islands	381	250	100%	2	2	100%

Public Phones	Modems	Telex Terminals	Systems PBX	Key
23,326	12,323	21,076	9270	
7542	15,273	24,674	43,961	32,140
153	65	366	661	746
850	60	1889	1638	4200
			12,122	222
10,063	16,063		13,767	11,557
2988	4859	7320	5631	206
158,036	46,351	145,547		
4747	785		14,222	
16,275	882	8659	13,694	26,304
525	270		599	
125,296				
642		1769	1868	
554	0		579	
11,500	12,355	7925	15,326	19,900
	1250		15,160	30,720
14,118		9678		
40,000	39,000	16,000	40,218	13,599
33,000	19,063	39,012	104,737	193,041
1461			970	835
77,000 ^c	81,547			

Public Phones	Modems	Telex Terminals	Systems PBX	Key
0	0	7	4	

Continued on next page

ever, that the pace of telecommunications enhancement (or development) is matching or leading the shift in the economic base of the industrialized countries and lagging it in the industrializing countries.

In many nations, public telephones often are the only means of access for residential telecommunications service. An exchange frequently is equivalent to a local switch and an excess of lines equipped versus lines in service often means that lines are inoperable, not that capacity for new service exists.

The blank spaces in Table I do not always mean, therefore, that a country failed to respond to our survey. In many instances, it simply means there was no installed plant in that category or that the respondents considered it too minimal to report.

The vast continent of Africa, for example, illustrates the gigantic size of the telecommunications development task. With few exceptions, an exchange consists of a single local switch, most of them under 5000 lines in size. Indeed, most of the local switches have only a few hundred lines; for instance, in lower Egypt and the Suez Canal area, 125 switches serve approximately 21,000 lines—an average of fewer than 200 lines per switch.

Throughout Africa generally, telecommunications services are concentrated in commercial centers. Even there, the reported numbers of modems, telex terminals, PBXs and key systems were insufficient to allow an extrapolation for the entire continent. Both the reported data and the blank spaces in Table I clearly show that most administrations will continue to concentrate funds on developing the telecommunications networks in the commercial centers.

The industrialized countries also are concentrating on the further development or enhancement of the network for business purposes. The telecommunications liberalization trend which already has swept the United States and is spreading throughout the industrialized nations is being stimulated by business, not residential, telecommunications concerns. The United States, for example, has 38% of the world's telephones and 4.5 million business establishments of various sizes. France, Germany and the United Kingdom together have 7 million business establishments and only

Continued on page 43

Table 2...continued

Africa

	Total Telephones	Lines		Total Exch	Local	Switches Under 5000 Lines
		Equipped	In Service			
Botswana	10,833			12		
Ethiopia	91,551			20		
Gambia	3744	2559	82%	13	9	100%
Lesotho	8800			34		
Mauritius	42,236				27	89%
Nigeria ^a	173,000			171		
Sierra Leone	12,500			13		
South Africa	3,208,730	1,970,915	86%	1620		
Swaziland	13,200			22		
Tanzania	93,238			133		
Togo	5850			10		
Tunisia	188,476			50		
Uganda	45,857			108		
Zimbabwe ^b	224,450			100		

a: In Nigeria, there were an estimated 171 exchanges in use in 1981. About 20% of those exchanges were equipped for subscriber trunk dialing. About 1910 PBXs and 205 PABXs were installed, with an average of 20 extensions. As of March 1981, about 1900 telex lines had been installed. Of the 2900 people on the waiting list for telex service, 1000 could be accommodated within the existing system.

b: In Zimbabwe, there are an estimated 7000 PBXs and key systems in service.

Table 3

Oceania, Asia, Middle East and Asia Minor

(Data as of Jan. 1, 1982, unless otherwise indicated)

	Total Telephones	Lines		Total Exch	Local	Switches Under 5000 Lines
		Equipped	In Service			
Zone 6						
Australia	7,684,336			5460		
Brunei	37,800				14	100%
Indonesia	450,000			80		
Malaysia	716,810			435		
New Zealand	1,798,802			826		
Papua New Guinea	48,500			47		
Philippines	897,000			187		
Singapore	787,000	824,000	69%	24	73	15%
Thailand	529,100	482,454	83%	196	204	84%
Vanuatu	3000	1800	90%		2	100%
Solomon Islands	2500	1600	89%		2	100%
Zone 8						
China, PRC ^a		700,000				
China, Taiwan	3,400,000	4,071,680	69%		481	52%
Hong Kong	1,822,846	1,749,247	84%		56	37%
South Korea	4,179,921			267		
Macau	18,000	17,700	90%		4	75%
Japan ^b						
NTT	58,332,000			6500		
Zone 9						
Bahrain	72,564			11		
India ^c	2,785,000			7900		
Iran	1,018,181			428		
Israel	1,290,000				125	53%
Kuwait	232,000	294,200	58%		19	26%

Public Phones	Modems	Telex Terminals	PBX	Systems	Key
	10		42		
817	3		795		
15	0	67	59		
37	0		514		
45			876		
			2100		
40	0		200		
29,703	19,184	25,211			
70			530		
323					
92			75		
600					
525			300		
856					

Public Phones	Modems	Telex Terminals	PBX	Systems	Key
31,976	43,995				
25	10	327			
5005	2231		7696		17,723
420	107				
14,478	435	11,952	2958		4267
7187	2239	3325	763		NA
5	6	55	39		19
10	0		49		30
59,115	3661	15,170	2275		41,133
721	4033		1809		33,669
62,025					
12	12	184	202		
913,924			110,000		
6237	300+				
8000		4300	7556		
460		3009	1192		

Continued on next page

16% of the world's telephones.

The distribution of business telecommunications equipment in Europe and the U.S. dramatically illustrates the telecommunications intensification characteristic of the movement toward an information-based economy: Western Europe has in service an estimated 1.1 million PBXs, of which 90% are under the 100-line size, 500,000 modems and 800,000 telex terminals.

The U.S. currently has approximately 220,000 installed PBXs and 3.2 million key systems.

These impressive figures probably do not tell the whole story, because many nations allow network interconnection of privately owned business telecommunications equipment. It usually must be approved or certified by the telecommunications administration and rarely includes residential telephones. The U.S., of course, is a notable exception.

Among the countries currently reporting approval of equipment for private purchase and interconnection to the public network are Argentina, Australia, Austria, Belgium, Canada, Chile, Costa Rica, Cyprus, Federal Republic of Germany, Finland, Japan, Hong Kong, Kuwait, Luxembourg, Macau, Peru, Portugal, Saudi Arabia, Singapore, Syria, Taiwan, Thailand, Trinidad and Tobago, and Venezuela.

Although private ownership of equipment and approved interconnection to the public network sometimes are signs of telecommunications liberalization, they do not necessarily signal an open market for suppliers. These arrangements have existed for decades in many countries, for example, Germany, that have competent, well-protected national manufacturers.

Where developed national markets are opening to outside suppliers, however slowly, the approval and certification procedures usually are enforced to the letter. The procedures that are reasonable and necessary according to the host country often seem burdensome to outside suppliers.

Even developing countries with clearly established telecommunications needs and programs are not necessarily open to all suppliers. Often, the loans, grants or other aid include an understanding that equipment will be purchased from manufacturers of the aid-providing country.

The remainder of this 1983 World
Continued on page 45

Table 3...continued
Oceania, Asia, Middle East and Asia Minor

	Total Telephones	Lines Equipped	In Service	Total Exch	Local	Switches Under 5000 Lines
Pakistan	370,000					
Qatar	67,895			28		
Saudi Arabia	443,000	984,744	62%		165	57%
Syria	286,000	262,045	88%		36	47%
United Arab Emirates	242,327			58		

a. Only figures counted for the People's Republic of China are PTT figures. The government's sixth five-year plan, 1981-85, calls for \$2 billion to \$3 billion to be spent for telecommunications expansion.

b. The number of switches in Japan is based on the proceedings of the International Symposium on Subscriber Loops and Services (September 1982). The telephone network has four hierarchical office ranks. There are 8 regional centers, 81 district centers, 562 toll centers and approximately 6500 end offices. PBX figures are based on NTT reporting. "The Japanese Market for Communications Equipment and Services" (U.S. Dept. of Commerce, Pacific Projects Ltd.) NTT had, as of Dec. 31, 1981, 6,234,000 key system telephones. Distribution was believed to be 800,000 small key systems of one subscriber line and four stations. The rest of the key systems are between 2 to 8 lines and 6 to 20 stations. As of Dec. 31, 1981, there were 58,000 telex subscribers.

c. In India, 70% of the local switches are rural with an estimated capacity of 25 to 100 lines. In Bombay, there are an estimated 3195 public telephones, 528 PBXs and 5045 PMBXs.

Table 4
The Americas

(Data as of Jan. 1, 1982, unless otherwise indicated)

Zones 1 and 5	Total Telephones	Lines Equipped	In Service	Total Exch	Local	Switches Under 5000 Lines
Canada						
TransCanada System						
Alberta Gov't	1,298,700	931,310	77%		361	89%
Bell Canada	9,609,430	7,257,000	85%		1031	79%
British Col.	1,977,000	1,339,584	89%		314	80%
Manitoba	706,100	530,125	89%		262	90%
Maritime	498,200					
New Bruns.	391,100	262,000	90%		110	88%
Newfoundland	201,800	174,087	79%		55	91%
Saskatchewan	623,300	487,000	82%		375	95%
Edmonton Tel	662,000	453,400	73%		26	0%
Northern	76,100	47,000	93%		32	91%
Thunder Bay	88,800	61,825	85%		10	70%
Sogetel-Quebec	17,000	11,253	84%		13	100%
Quebec Tel	283,500					
Bahamas						
Grand Bah. Tel	15,315			2		
Bahama Tel	60,000	32,090	81%			
Barbados	66,600			8		
Bermuda	48,958	30,000	84%		5	80%
Costa Rica	207,717	189,611	85%		109	89%
Cuba	275,000					
Guatemala	148,596			52		
Jamaica	127,000	71,600	82%		41	89%
Nicaragua	56,000					
Panama	175,000					
Puerto Rico						
Puerto Rico Tel	679,458			100		
PR Comm Auth	72,200					

Public Phones	Modems	Telex Terminals	Systems PBX	Key
1926		12,111	695	
223		900		

Public Phones	Modems	Telex Terminals	Systems PBX	Key
76,079				
11,551	7500	350 ^a 235 ^a	3346	16,290
2887	1493		429	6058
2073	260		291	4900
3625	2689	272 ^a	1118	4320
3075	4500	1800 ^a	952	9257
470	82	26 ^a		
580	140	0 ^a	127	1725
97	14	2 ^a	30	
112			37	329
181	17	520		
202			239	489
596	6		198	775
2679		1165	42	
922			600	
644		320	985	937
6200	1400		990	6500

Continued on next page

Telecommunications Survey contains comments from various administrations on their development plans, industry trends and, in a few instances, data which arrived too late for inclusion in the tables.

Prospects for the future

The Western developed countries' thrust for the immediate future is toward enhancing business telecommunication services and continuing work toward the integrated services digital network (ISDN). Edmonton Telephones and British Columbia Telephone Co., both Canadian companies, plan to continue their replacement of electromechanical switching equipment with digital equipment and to incorporate increasingly fiber optic technology into the network, initially at the interoffice trunking level.

Progress toward the ISDN, according to B.C. Tel's Vice President-Corporate Development Colin G. Patterson, should clarify the "dilemma over the location of intelligence vis-a-vis the network and terminals."

Patterson also pointed out that Canada's increasing liberalization of telecommunications policy will result in a highly active and competitive terminal equipment marketplace with suppliers eventually settling down to focus efforts on selected market niches.

In the U.K., another liberalization arena, development of competition is accompanied by keen interest in the possibilities technology holds for the business user. D. Wray, British Telecom's director-business planning and strategy development, noted that while most of the U.K. telephone network's physical expansion still is driven by increasing demands for voice services, "Within the network there is an accelerated drive toward integrated digital working providing flexible facilities for voice and non-voice telecommunications, including both narrow and wideband specialized services." Wray also speculated that the coming few years "could also see the start of a significant expansion on the wideband local network front, which the U.K. government is keen to see developed, not simply for cable television, but as the basic infrastructure for a society based on Information Technology including interactive and full video facilities."

Interests of the Deutsche Bundespost, Federal Republic of Germany,

Continued on page 47

Table 4...continued

The Americas

	Total Telephones	Lines Equipped	In Service	Total Exch	Switches Local Under 5000 Lines
Trinidad and Tobago	83,000	56,800	79%		32
Dominican Rep.	165,253			20	91%
Virgin Is. (U.S.)	44,285			6	
Mexico					
TELMEX ^b	5,275,000	2,870,644	95%		879
Argentina					
Private	352,037	211,550	89%		60
PTT	2,528,727	2,174,000	86%	1276	77%
Bolivia	135,000				
Brazil	8,159,000	5,936,944	89%		3502
Chile	569,696	426,385	91%		247
Colombia	1,623,105				89%
Ecuador	259,000			121	
El Salvador	72,700			42	
Paraguay	58,700				
Peru					
ENTEL	117,020	108,880	82%		100
CPTSA	370,103				92%
Suriname	25,000				
Uruguay	287,140				
Venezuela	929,000	1,241,591	69%		449

a. These figures are for TWX, not telex, terminals. TWX service is used throughout Canada.

b. Telefonos de Mexico S.A. (TELMEX) is the PTT of Mexico. Direccion General de Telecomunicaciones (DGT) is responsible for the national microwave network, satellite communications and telex services. In 1980, telex connected 106 domestic locations (64 automatic exchanges and 42 through long distance bar), as well as connecting Mexico with 10 countries. Installed capacity was 11,000 terminals. 8131 terminals were in use.

This announcement appears as a matter of record only.

Southern New England Telephone Company

has formed

SONECOR Credit Corporation

A Joint Venture With
Borg-Warner Acceptance Corporation

*The undersigned assisted Southern New England Telephone Company
in the formation of SONECOR Credit Corporation.*

Lehman Brothers Kuhn Loeb

Incorporated

NEW YORK • ATLANTA • BOSTON • CHICAGO • DALLAS
HOUSTON • LOS ANGELES • SAN FRANCISCO • LONDON • TOKYO

February 16, 1983

Public Phones	Modems	Telex Terminals	Systems PBX	Key
259	0	253	629	40
740			414	1936
337			67	880
28,587			23,514	
1465			827	
17,150				
59,200	4042	50,130	2188	
8857				
21,000			3140	
345				
955				
1545			636	
18,407				

center on incorporating digital technology and fiber optics into the telecommunications network to provide traditional services as well as new ones. Specifically, German efforts will be directed toward development of the national interactive videotex service, Bildschirmtext, now undergoing field trial. The Bundespost expects to expand the system to handle 1 million subscribers by 1986. A national German telecommunication satellite also is under consideration as one element in a digital, optical fiber network for service-integrated facilities and broadband services. In the area of fiber optics itself, the Bundespost will purchase an average of 100,000 km of optical fiber cable each year for 10 years beginning in 1985, for use in its long distance network. One reason for this planned purchase, the Bundespost has indicated, is to provide optical cable manufacturers with a basis for calculation so they can work toward economical production methods and volumes.

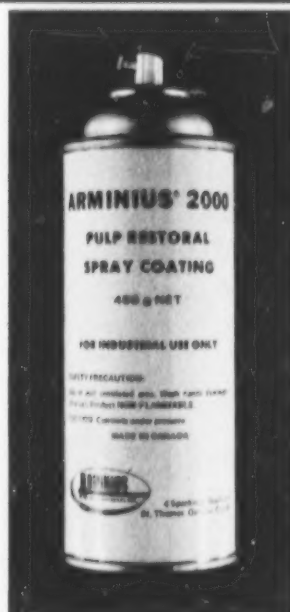
Business interests likewise drive the Belgian telecommunications administration. Notable achievements and remaining goals pointed out by A. Serrure, general director of the

Continued on page 88

ARMINIUS® 2000

PULP RESTORAL SPRAY COATING

- ☐ New - Unique
- ☐ Economical restoral of brittle and/or bare copper conductors ('shiners'), pulp insulated in cable sheath openings. No more costly replacing of brittle splices.
- ☐ May be applied on 'LIVE' conductors.
- ☐ Abrasion resistance of treated conductors better than on new ones.
- ☐ Anticorrosive.
- ☐ Non-toxic; non-flammable.



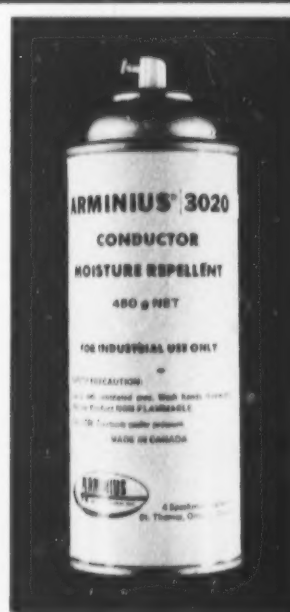
*Proven International Track Record
Ask for More Information Today*



ARMINIUS® 3020

CONDUCTOR MOISTURE REPELLENT

- ☐ New moisture repellent used during 'open time' when splicing pulp/paper insulated conductors.
- ☐ Economical.
- ☐ Non-flammable.
- ☐ Non-corrosive.
- ☐ May be applied on 'LIVE' conductors.



At



the research and development firm
where NEW TECHNOLOGY is
coming from . . .

Continued from page 47

Regie des Telegraphes et des Telephones (RTT), include 1982 initiation of a national data packet-switching network, Data Communication Service (DCS); and plans for a telex center, using time division multiplexing. In 1984, Serrure pointed out, the first telex subscribers will be able to be connected to this system with V21 modems. A teletex service also will become operational within the year, operating on the DCS network and will be interactive with telex service. Another service planned to make use of the DCS is a "mailbox" message service, scheduled for operation in late 1983.

Comments from two Scandinavian telecommunications operations, the Norwegian Telecommunications Administration and Jysk Telefon in Denmark, indicated total and irrevocable commitments to digital technology. Jysk Telefon's decision not to purchase more analog switching equipment went into effect Jan. 1. And, plans are underway to establish a broadband digital network using optical fibers.

For their part, the Norwegians are going digital in a big way, and the government has invited tenders from

several digital switch suppliers for delivery of a total of 500,000 lines. In addition to two Norwegian companies, three foreign vendors have responded to the invitation, and one will be chosen this year. An order of 500,000 lines will serve to replace a major portion of the Norwegian telecom network, and the agency hopes to further reduce its telephone service waiting list, which in 1979 reached 94,000. The administration already has made inroads on this problem, and by the end of last year the waiting list had been halved, to approximately 47,000.

The Norwegians anticipate full automatic service in 1985, when the automatic mobile radiotelephone service is planned to serve the entire country. (Norway already has 42,000 mobile radiotelephone subscribers, more than any other country in Europe).

Although separated by thousands of miles from Western Europe, Australia has nearly identical aims and ambitions for its telecommunications network. While demand at the top end of the PABX market is expected to be toward integrated voice/data systems, it also is expected that the lower market levels

will continue to have their needs met with stored program control voice systems. Telecom Australia will introduce two new services: Digital Data Service (a high quality, end-to-end service designed for users with centralized teleprocessing applications); and AUSTPAC, a high performance, packet-switched data service.

At Hong Kong Telephone Co., Managing Director F.L. Walker anticipates steady growth in basic telephone service as a result of the creation of new towns throughout the territory. Hong Kong Tel currently has 1,749,247 equipped lines, with 84% in service. Of its 56 local switches, 37% have fewer than 5000 lines. And, liberalization trends also have shown themselves here: "With effect from Jan. 1, 1983, Hong Kong Telephone's non-franchised communication services were excluded from its government-imposed scheme of [financial] control, a profit limiting device. The company can thus compete with other suppliers on an equal footing. As a result, the company's diversification program, which now includes radio paging, viewdata, Financial Vision and Datel Message Service (using a store and forward transmission model), will continue to expand in 1983," Walker commented. The company also plans to offer premium telephone devices and services this year and an automatic mobile radiotelephone service that will provide local and international communication to land vehicles and pleasure boats in in-shore waters. This activity on the part of Hong Kong Tel may boost its current figures of 1809 PBXs, 33,669 key systems, 485 TWX terminals and 4033 modems.

Optical fiber installations are planned for the junction network, as well as digital switching.

Also on the Asian scene, Macau, with 17,700 equipped lines, is planning an underground ducted fiber optic system as the foundation of its new digital telephone system which will be initially equipped for 23,000 lines. This massive addition is scheduled for service in July. The new digital exchange will have international capability with "improved" terrestrial connections to Hong Kong and Guangdong Province in the People's Republic of China and other countries via a type B satellite terminal, according to Managing Director R.O.L. Histed.

If continued enhancement of an al-
Continued on page 90

TII's All New Family of Electronic Relays

- Longitudinally balanced
- All solid-state design
- Easy installation
- For use on Automatic Electric, Northern Telecom, Western Electric and British Post Office step equipment.

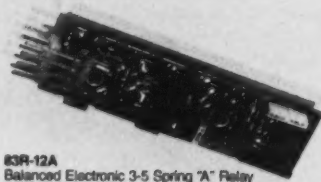


Call us for information
on relays for other
applications.

TELEPHONE INDUSTRIES, INC.

A subsidiary of Electrospace Systems, Inc.

P.O. Box 481 • Ballinger, Texas 76821 • 915/365-2555 800/351-1361



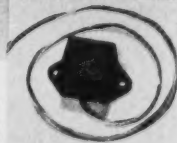
83R-12A
Balanced Electronic 3-5 Spring "A" Relay



83R-13
Balanced AEI Electronic "A" Relay



83R-14
Balanced Electronic
"CB" Relay



83R-6
Electronic
Contact

ready refined network is the aim of most of the developed countries covered by TELEPHONY's survey, establishment of a solid, modern network is the goal of a number of still-developing nations.

For example, John Titus Narh Roberts, chief telecommunications engineer in Gambia's telecommunications department, explains, "Gambia is one of the few countries in West Africa still using the first generation type of switching equipment in its national telecommunications network. Due to the obsolescence of this equipment and the fact that it is becoming more and more difficult to maintain because of the scarcity of some essential parts, it has become absolutely necessary to replace the existing system."

The Gambia project, to be tendered early this year, will divide the country into three main Telephone Group Areas, each with a designated Group Center to which towns and villages will be linked through their respective local telephone exchanges by PCM (pulse code modulation) microwave channels. The completed, digital network will include an International Gateway Exchange and a national transit exchange for routing

calls between Group Centers. The plan is to develop the network in two phases, but how firm the schedule is depends on funds availability, according to Roberts.

Zambia, says A. Kumar, assistant director-planning and development for the Posts & Telecommunications Corp., soon will commission 20 automatic rural exchanges, and radiotelephone systems to serve about 900 rural subscribers. A high capacity microwave link also is planned that will connect Zambia to the African nations of Botswana and Zimbabwe. A digital international exchange at Lusaka is planned for 1984.

On the other side of the Atlantic, Costa Rica will begin a project of digital switching installation that will give it a telephone density of 11 phones per 100 inhabitants, the highest figure in Central America, according to Marco Cruz, assistant director-engineering division, Instituto Costarricense de Electricidad. There, Cruz notes, plans are to serve 871 rural communities with rural public telephones; and approximately 510 telephones will be installed in "productive centers," such as farms, tourist

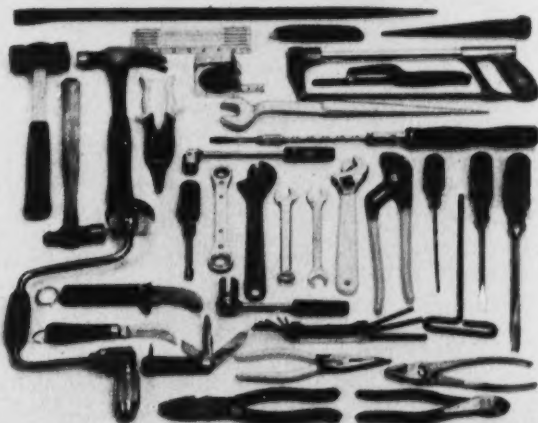
resorts and rural industrial facilities.

Bermuda will begin replacing its electromechanical central offices with digital systems this year and shortly plans to achieve totally electronic switching networks.

In this all-electronic goal, Bermuda is joined by South Africa, where the object is to "phase out all existing electromechanical exchanges early in the next century," according to E. Stacey, director, Dept. of Posts & Telecommunications. Optical fiber cable systems will play a major role in digitizing the local junction networks. South Africa also will push business-oriented offerings, including a switched data network, electronic mail and electronic funds transfer systems.

A few telecommunications authorities contributed figures to TELEPHONY's survey too late to include in the tabular material. These include: Spain, lines equipped, 8,805,175, with 85% in service; local switches, 2973, with 86% of them having fewer than 5000 lines; PBXs, 34,588; key systems, 195,437. Israel has 1,039,900 lines equipped, with 89% of them in service; 125 local switches, 53% with fewer than 5000 lines; and 7556 PBXs. □

Klein plier quality in every type of hand tool. They feel right. They work right. Klein tools for professionals. You can buy them from authorized Klein distributors in your area. . . at competitive prices.



88312

KLEIN
An Independent,
family-owned company
...since 1857.

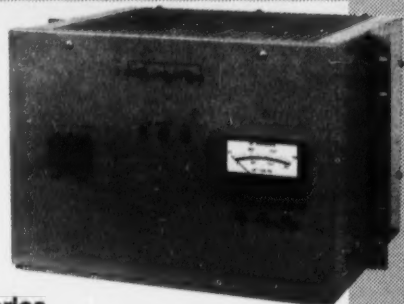


Send for
FREE
160-Page
CATALOG

Klein Tools, Inc. 7200 McCormick, Chicago, Ill. 60645

Check No. 69 on Reader Service Card

BATTERY CHARGERS/ ELIMINATORS



RG Series

- UL Listed
- 48 and 24 VDC Models Available
- Regulated Ferroresonant Technology
- Compact Design

Contact Factory For Price/Delivery
Information

WARREN COMMUNICATIONS

Newtown, Rd., Littleton, Mass. 01460
(617) 486-3575

WC83-I

A UNIT OF GENERAL SIGNAL



WARREN

Check No. 70 on Reader Service Card
TELEPHONY/February 28, 1983

INTERNATIONAL ISSUE

telephony

APRIL 25, 1993

CR700-1 4/20/93

THE JOURNAL OF TELECOMMUNICATIONS SINCE 1901

TOP NEWS: Bell spinoff company to be called U S West, p.13
New NTS plant cost allocation procedure unveiled, p.16
BT Chairman Jefferson blasts British equipment industry, p.18

Cover: Feisty French telecom chief Jacques Dondoux speaks his mind, p.26
Plus, exclusive features from China, the Pacific, the U.K. and Canada . . .

TY
MD20814CONGLIKENYJ FCG8223 C
J KENNEDY SRI
CONGRESSIONAL INFORMATION SERV
STE 800
4520 EA WEST HIGHWAY
BETHESDA MD 20814



BEST AVAILABLE COPY

April 25, 1983

VOLUME 204
No. 17

telephony

News of the Week 13

AT&T regional company picks name • ITT, Ericsson compete for Italian contract
• Japanese exhibition goes international

34 Telecommunications for a billion Chinese

An inside view of the status and plans of China's Postal Communications and Telecommunication Ministry
Zhu Gaofeng

Joint board adopts new allocation approach 16
In the U.S. Capital: AT&T wins approval of service filing waivers • Washington Round-Up
Victor Block

40 Satellite service options for the Pacific

An analysis of the results of a study comparing the feasibility of alternative satellites options and pricing scenarios for the Pacific region
Marcellus S. Snow

BT chairman blasts British equipment industry 18
European Liberalization: Mercury seeks suppliers for monomode FO cable
R.J. Raggett

43 All you wanted to know about digital switching

Here's a checklist that will help non-experts analyze and compare digital switches from various manufacturers. First of a two part series
Terry Meredith and Graham Langley

Tool for progress 25

As We See It: By recognizing the value of communications as a tool for economic and social progress, advanced and developing countries can gradually erase their differences

48 International Teletraffic Congress

In keeping with a 28-year tradition, the 10th ITC, scheduled for Montreal, will offer a forum for ideas on teletraffic issues
Owen McAleer

COVER STORY: French telecommunications 26

An exclusive interview with Jacques Dondoux, France's director of telecommunications, by R.J. Raggett

52 Lincoln Tel & Tel enters retail market

Plant Man's Notebook: To cut costs, Wisconsin Tel initiated a personal leave program for employees
Ray Blain

DEPARTMENTS

Advertisers' Index 96
European Liberalization 18
In the U.S. Capital 16
Meetings 11
Merits & Milestones 98

81 Moving Around Industry
56 New Products and Services
13 News of the Week
52 Plant Man's Notebook
9 Reader Service Card

Published by TELEPHONY PUBLISHING CORP.,
55 E. Jackson, Chicago, IL 60604
Telephone 312/922-2435; TWX 910 221 1058

European Bureau, 136 Broomfield Rd.,
Chelmsford, Essex CM1 1RN, England;
Telephone Chelmsford (0245) 58257;
Telex 995801 GLOTLX-G.

TELEPHONY (ISSN 0040-2656/83-0+\$1.50) is published weekly (except twice weekly during the second week of August and three times during the month of December) by Telephony Publishing Corp. Officers of Telephony Publishing Corp. are Dan S. Fargo, President; Leo Anderson, Del Myers and Ed Robinson, Vice Presidents. Postmaster: Please send form 3579 to Subscription Dept., TELEPHONY, 55 E. Jackson Blvd., Chicago, IL 60604. Second class postage paid at Chicago, Ill., and at additional mailing offices. Single copies (payable in advance) U.S. \$3.00 ea., issues over 2 years old \$3.50 ea. Outside U.S., add \$1.00 ea. Subscriptions: \$29 one year. Outside U.S. add \$20 per year. Subscription rates apply to employees of operating telephone companies; telephone consultants; contractors; interconnect companies; specialized common carriers; mili-

tary government associations; private communications users; schools; libraries. All others \$35 one year. Outside U.S. add \$20 per year. Change of address: include old address as well as new address. Attach issue label if possible. Allow 4 weeks for change to become effective. Copyright 1983 by Telephony Publishing Corp. Permission to photocopy for internal or personal use or the internal or personal use of specific clients is granted by Telephony Publishing Corp. for libraries and other users registered with the Copyright Clearance Center (CCC) provided that the fee of \$1.50 per page is paid directly to CCC, 21 Congress St., Salem, MA 01970. Special requests should be addressed to Telephony Publishing Corp.

Comparing costs vs. elasticity of demand guides satellite plans for the Pacific region

In 1981, researchers spent 7 months studying the communications needs in the Pacific basin area, and recommended use of satellite technology for this communications-poor region. Preliminary findings were summarized in *TELEPHONY*, April 26, 1982, p. 60. A follow-up study, discussed here, compared the feasibility of alternative satellite options and pricing scenarios.

MARCELLUS S. SNOW

TRAVELING for 7 months among the islands of the Pacific early in 1981, study team members of the Public Service Satellite Consortium (PSSC) talked to prime ministers, telecommunications officials and engineers, fishermen, village elders and other people about the need for better communications facilities. They heard a familiar litany of complaints: connections from the capital city to gateway cities on the rim of the Pacific, such as Sydney, Tokyo or Los Angeles, were often better than those between the capital city and hinterland villages a few miles apart, and existing local and rural service was poor and undependable.

The PSSC team reported its findings to the National Aeronautics and Space Administration (NASA) of the United States. Jane Hurd, one of the PSSC investigators, has summarized the NASA report in these pages (*TELEPHONY*, April 26, 1982, p. 60). Further work by PSSC professionals and other consultants was then undertaken at NASA's behest. I will summarize my role and findings in this consulting exercise with regard to alternatives for satellite service to the Pacific island areas in the near- and medium-term future.

As part of PSSC's follow-up study for NASA, I was asked by Elizabeth Young, PSSC's president, and Louis Bransford, vice president for planning and development, to examine

certain aspects of providing satellite services to the Pacific basin. Specific topics were to include: a comparison of costs involved in using facilities of INTELSAT (International Telecommunications Satellite Organization) and INMARSAT (International Maritime Satellite Organization) to satisfy near-term needs; a discussion of meeting longer-term needs in the region; the role for improved telecommunications in promoting economic development in the Pacific; and various political and institutional considerations in upgrading telecommunications on a regional basis.

Other consultants for PSSC included Walter Morgan, a telecommunications engineer in the Washington, D.C., area; Don Lamberton, an economics professor at the University of Queensland, Australia; and Neil Karunaratne, also on the University of Queensland faculty and then serving as professor and head of the Dept. of Economics at the University of the South Pacific in Suva, Fiji. Hurd served as project coordinator.

Physically, my collaboration took me first to Washington in April 1982 for coordination of my efforts at PSSC headquarters; and 2 months later to Suva, Fiji, where I spent 1 week at the regional development office of the International Telecommunication Union (ITU). There, with access to the telecommunications experience and expertise of Graham Davey, ITU project manager, and his professional staff, I developed the data and methodology necessary to complete my report. In addition, the Suva visit put me in contact with Dr.

Karunaratne, whose completed report for PSSC provided input data regarding traffic and facilities projections; it also gave me a chance to visit with officials of the South Pacific Bureau for Economic Cooperation (SPEC), a body long concerned with telecommunications needs in the Pacific.

My report for PSSC, completed in July, was included as part of PSSC's overall follow-up report to NASA, entitled "Satellite Communications for the Pacific Islands," which was issued last December. The Pacific Telecommunications Conference, held this January in Honolulu, offered opportunity to present my conclusions.

Any comparison of costs of alternative systems must presuppose estimates of traffic demand and facilities required to satisfy that demand. Ideally, demand would be developed in such a way as to depend on the price charged; price would depend on costs incurred; costs would depend on the extent and type of facilities provided; and facilities would in turn depend on demand. This type of interdependent system would best capture the many interrelationships involved. An economist, in particular, is loath to accept autonomously growing traffic projections arrived at by crude extrapolation from past trends, with no explicit assumptions about the relation of demand to the price of services. Nevertheless, constraints of time and methodology dictated a projection of traffic and facilities for the Pacific region which, while disaggregated quite minutely by source and type of traffic, had little explicit recognition of the price mechanism built into it.

In my portion of the work, traffic and facilities figures were broken down into two classifications. First, rural and urban traffic were kept distinct. In addition, the French-speaking areas of the Pacific (French Polynesia and New Caledonia) were treated separately because of their status as overseas departments of a metropolitan power that are not lo-

Marcellus S. Snow is Associate Professor of Economics at the University of Hawaii, Honolulu. This article is based on a presentation Snow made at the Pacific Telecommunications Conference (PTC '83), Jan. 16-19 in Honolulu.

cated on the Pacific rim area.

Initially, the INTELSAT and INMARSAT options were compared over the 7-year period from 1985 to 1991; then the option of a separate, dedicated, multipurpose system was examined for the 9-year period from 1992 through 2000.

Figures provided by Dr. Karunaratne projected total regional traffic growth from 30.2 million paid minutes (equivalent voice circuits) in 1985 to 59.4 million in 1991. Of this, 23.1 million (in 1985) and 49.7 million (in 1991) came from urban users. The demand in paid minutes was then translated into voice-grade circuits on the basis of the following equivalences supplied by telecommunications engineers: 1 circuit per 10,000 annual paid minutes for rural traffic, and 1 circuit per 20,000 annual paid minutes for urban traffic. This yielded a need for 1904 circuits regionwide in 1985, of which 1204 were urban, growing to 3534 in 1991, including 2574 urban.

Next, voice circuits were translated into equivalent earth stations, on the basis of advice from ITU experts. The ratios used were 1.33 circuits per year equal 1 earth station for rural traffic; and 4.0 circuits equal 1 earth station for urban traffic. These ratios presupposed particular types of antennas configured in particular ways. The requirement was made that earth station capacity to be installed in 1985 for the interim system, whether the space segment was to be furnished by INTELSAT or INMARSAT, would be sufficient to satisfy demand through 1991, the end of the interim period. This condition meant that 1271 earth stations would be needed in 1991, including 654 for urban traffic and 617 for rural usage.

Finally, satellite transponder requirements, on the basis of 600 to 700 voice circuits each, were projected. The need rises from three transponders in 1985 (two urban and one rural) to seven in 1991 (five urban and two rural).

Differing cost assumptions require separate treatment of the INTELSAT and INMARSAT options.

INTELSAT costs

The assumption was made that INTELSAT transponders would be used at the current lease rate for interruptible domestic service, which is \$800,000 per year. This is a service which INTELSAT has made available since 1973 to dozens of user countries. INTELSAT space segment lease costs would accordingly grow

from \$2.4 million in 1985 to \$5.6 million in 1991.

Earth station costs were calculated as follows: Each of the 18 political entities in the Pacific basin was assumed to require one large base earth station for domestic and international interconnectivity. These would be roughly equivalent to the INTELSAT B standard in quality and price, and were assumed to cost \$1 million each. The remaining 1253 earth stations were assumed to cost \$120,000 each, having dishes of approximately 6.5 meters in diameter and providing power of 10 watts per channel.

Each base earth station was assumed to need a full-time expatriate manager, at an annual salary growing from \$31,000 in 1985 to \$54,900 in 1991, and a senior technician would be required at every earth station at an annual salary increasing from \$10,600 in 1985 to \$18,800 in 1991.

Miscellaneous overhead was assumed to be \$5000 per circuit per year, which was an arbitrary amount. This traffic-sensitive figure was allowed to cover recurring maintenance expenses, non-technical labor and, importantly, construction and maintenance of terrestrial links from the earth stations to existing networks. Together, technician salaries and overhead yielded operating and maintenance costs which grew from \$23.6 million in 1985 to \$42.6 million in 1991.

Earth stations were depreciated over 15 years based on the assumption of an 8% loan over the same period—an interest rate clearly below market levels but reflecting options available from international development lenders such as the World Bank. Lasting 15 years, the earth stations would have more than one-half of their useful life remaining after the expiration of the interim period at the end of 1991. Earth station depreciation would account for \$11.2 million annually during the 1985-91 period, while interest on the outstanding principal balance would decline from \$13.3 million in 1985 to \$9.5 million in 1991.

Adding costs of transponders, operation and maintenance, depreciation and interest yielded total system costs of \$50.5 million for 1985, increasing to \$68.9 million in 1991. This corresponded to a cost per circuit of \$26,504 in 1985, declining to \$19,509 in 1991. On the basis of cost per paid minute, the figures were \$1.67 per paid minute in 1985, declining to \$1.16 in 1991. Exclusion of

traffic from French areas reduced total system costs by about 30% throughout the period, but lost economies of scale cause per circuit costs to increase to \$28,942 in 1985 and to \$21,193 in 1991. Similarly, omission of French traffic raised per minute costs to \$2.02 in 1985 and to \$1.36 in 1991.

INMARSAT costs

By using higher-powered and more expensive satellites than INTELSAT, INMARSAT allows cost savings in earth stations, which can be smaller, less expensive and have lower power. Furthermore, INMARSAT capacity is provided and tariffed on a demand assignment basis, meaning that links are established as needed, in lieu of circuits leased between pairs of member administrations.

In 1982, INMARSAT was charging its member administrations \$5.25 per minute on a demand-assigned basis for a voice-grade circuit. Unlike INTELSAT, INMARSAT has not yet offered high-volume services at bulk or discount rates. If there was no assumption that lower rates could be offered to Pacific basin users, overall INMARSAT costs would exceed those of INTELSAT. Thus, the assumption was made in the PSSC study, which involved difficult institutional ramifications, that one of two concessionary rates would be approved by INMARSAT: \$2.00 per minute or \$1.00 per minute. The same number of regular non-base earth stations was assumed for INMARSAT, and at the same cost. Five large regional earth stations were projected, rather than 18. Due to the higher power of the INMARSAT satellite, however, the regular earth stations could be cheaper: \$50,000 each instead of \$120,000. As before, \$1 million was taken as the cost of the few large earth stations. Again, a 15-year, 8% loan was assumed. Maintenance and overhead were projected to fall from \$5000 annually per circuit to \$3000 in the INMARSAT case. While one technician per large earth station still would be needed, the simpler nature of the regular earth stations appeared to justify requiring one local senior technician per three such earth stations, keeping the number of senior technicians per dollar's worth of earth station constant in both the INTELSAT and INMARSAT scenarios.

When totaled, these INMARSAT expenses yielded per minute circuit costs of \$2.67 in 1985 and \$2.46 in 1991, assuming a \$2.00 per minute

Table 1**Comparison of INTELSAT and INMARSAT costs for Pacific basin interim satellite system**

INMARSAT total cost as percentage of INTELSAT total cost
Including FP/NC Excluding FP/NC

Year	SS Cost = \$2.00/min	SS Cost = \$1.00/min	SS Cost = \$2.00/min	SS Cost = \$1.00/min
1985	159.9	100.1	139.0	89.4
1986	167.4	103.6	144.1	91.6
1987	173.8	106.7	152.8	96.0
1988	183.9	111.8	158.9	98.8
1989	192.1	115.8	168.6	103.8
1990	203.0	121.4	178.9	109.1
1991	211.8	125.7	186.8	112.6

space segment charge. These costs fell to \$1.67 and \$1.46, respectively, when a \$1.00 charge was assumed. In contrast to the INTELSAT case, exclusion of French traffic from an INMARSAT system increased per minute costs by only 5% to 10%.

Table 1 compares INTELSAT costs with INMARSAT costs over the 9-year interim period. INTELSAT is superior on an overall cost basis; in some instances it has a more than two-to-one edge over INMARSAT. Only during the years 1985-1988, under the double assumptions of an extremely low INMARSAT space segment charge (\$1 per minute) and exclusion of French traffic, does INMARSAT show a slight cost advantage.

The projected INTELSAT costs, roughly in the range from \$1 to \$2 per minute, compare favorably with prices presently being charged by Pacific basin telecommunications administrations. Fiji, for example, charges the equivalent of \$1.69 per minute to all Pacific islands; and Papua New Guinea charges \$1.50 per minute for calls to Australia.

A permanent system, 1992-2000

Despite the advantages of leasing space segment capacity for the near term, consideration should be given to acquisition by 1992 of a separate, dedicated satellite system owned by the Pacific basin entities. System ownership was to be vested in an organization with the form of an economic cooperative such as INTELSAT, in which investment percentages are periodically realigned to reflect recent past usage. Larger traffic requirements by then might make economies of scale strong enough to justify a separate system.

In addition, I urged that the system be multipurpose in nature, and

not limited to conventional telecommunications. Use of the system for purposes such as earth resource surveys, meteorology, health, education and public administration would surely accelerate the process of economic development, which in turn is linked with the expansion of telecommunications demand, capacity, quality and variety. Also, international lending agencies such as the World Bank would look more favorably on a system that took developmental requirements into account more explicitly. On the basis of less elaborate methodology and bolder assumptions, a permanent, dedicated system was found to yield annual per-circuit costs of \$7000 to \$10,000 by the year 2000, compared with per-circuit costs of roughly \$19,500 to \$24,500 for 1991, the end of the interim period.

Recovery of costs

Average-cost pricing, while administratively convenient and conceptually straightforward, does not take into account the cost of the last—or marginal—unit provided, or variations in the ability to pay—elasticity of demand—among different user groups. For this reason, it is a relatively inefficient way to recover costs. The overall economic welfare of users can be better promoted by other charging methods.

One pricing approach often proposed is marginal-cost pricing, which involves charging the cost of the last or marginal unit provided. While this procedure has desirable welfare characteristics, it fails to recover total costs in industries such as telecommunications which enjoy economies of scale, since marginal costs are then less than average costs. A second-best solution often discussed by economists and occa-

sionally applied in practice is inverse-elasticity pricing, often called Ramsey pricing.

Basically, inverse-elasticity pricing involves charging markups above marginal cost in inverse proportion to the price elasticity of demand—ability to pay and sensitivity to price—of different user groups. This means, in practice, that users relatively sensitive to price—those with high demand elasticities—are charged less than users relatively insensitive to price, who have low demand elasticities.

Economies of scale make marginal-cost pricing impossible in the INTELSAT case, so I compared average-cost and inverse-elasticity pricing scenarios, along with two hybrid tariff structures. For the average-cost case, both urban and rural users were charged \$26,504 in 1985, which exactly captured total operating costs. To illustrate inverse-elasticity pricing, I assumed an urban price elasticity of demand of -0.8, and a rural elasticity of -1.2; thus, in absolute terms, rural users were assumed, with considerable empirical and theoretical justification, to be more price-sensitive. (The figure -1.2 means that a 1.0% increase in price causes a 1.2% decrease in demand.)

Application of the Ramsey pricing criterion indicated an approximate charge of \$30,000 per circuit to urban users and \$11,250 to rural users. Because they are only slightly price-conscious, urban users reduced their circuit demand minimally, from 1204 to 1090 circuits; while the large price reduction for rural users raised circuit demand from 700 to 2017. In this way, total circuits increased from 1904 to 3107, while total costs increased only slightly, from \$50.5 million to \$56.5 million. Total costs continued to be covered under Ramsey pricing, and rural users had their aggregate welfare greatly increased with more circuits used at a lower price, at only a small welfare loss to urban users who used slightly fewer circuits due to the higher price.

Much debate has been devoted to the question: "Does improved telecommunications cause economic development, or is it the other way around?" To assume or to require that the causality be unambiguously in one of two directions is simplistic. Both directions of causality can be accommodated, for example, in an econometric system of simultaneous equations. The concept of bidirectional

Continued on page 80

Continued from page 42
tional causality between telecommunications infrastructure and development causes no theoretical difficulties.

Nevertheless, telecommunications planners in the Pacific basin and elsewhere are understandably reluctant to plunge many millions of dollars into a new satellite system without some promise of a payoff in terms of economic development.

Should they wait for expansion of the telecommunications system to become a virtual necessity for further economic progress, letting it become something of a bottleneck or a constraint? Or should they take a bolder course by building ahead of demand, with the expectation or hope that a reliable telecommunications system would attract economic growth that would not otherwise materialize?

In the remote areas of the Pacific basin, as elsewhere, prompt and dependable availability of financial and other information is an absolute requirement for access to the market economy. Banks, airlines, tourism agencies, department stores and financial institutions all require the quality and quantity of information

flows that can only be provided by upgraded telecommunications systems. And economic development, conceived of in its most elementary form as a sustained rise in real national income per capita, depends on the expansion of markets and of the market economy. Thus, at least in the Pacific area there seems to be little doubt that improved telecommunications will be vital to continued economic development of the region.

Institutional challenges

A number of structural problems must be addressed if either an interim or a permanent satellite system is to emerge in the Pacific basin:

- INTELSAT must make its concessionary transponder lease rate of \$800,000 per year available for Pacific basin traffic, much of which is intraregional, but is technically international;

- INTELSAT must allow carriage of international traffic over non-INTELSAT facilities after 1992, when the dedicated separate system is introduced;

- INMARSAT must be persuaded to allow use of its facilities for shore-to-shore traffic;

- INMARSAT must be convinced to offer a concessionary rate to high-volume users of \$1 to \$2 per minute;

- Difficult questions about ownership and management of the interim and permanent systems must be addressed. In particular, it is preferable for the permanent system to be owned by the user entities in an economic cooperative arrangement, so their incentives as users and owners balance out, as in INTELSAT;

- A regional focus or headquarters is necessary. Fiji appears well suited for this role because of the ITU and SPEC presence there, as well as its extensive past participation in regional telecommunications questions;

- To encourage participation by French entities in the Pacific basin system, SPEC and the Pacific Forum (the prime ministers in the Pacific region) are the appropriate foci to draw French Polynesia and New Caledonia into the planning process. The ITU also might be helpful in the process, as would diplomatic contacts from other metropolitan powers with interests in the region, such as the United States, Japan, Australia, and New Zealand. □

AIR GAP ISOLATION
PROTECT 18 65
kv rms
cont
kv

Positron Telene Isolator for Power Station Communication

There is a better, more practical way than bulky neutralizing and isolation transformers to protect telephone, wireline and equipment in high voltage environments. Positron is fail-safe and offers solid state plug-in module adaptability.

- Safe, uninterrupted operation even in severe case power fault conditions.
- Safe, easy installation by one person in less than two hours.
- Significant initial and long term savings.
- Every service module provides the same high protection level.
- No neutralizing pairs.
- Prompt deliveries from stock.
- Services: telephone, PBX, ac data, telegraph, remote relay
- Surge, dc trip, dc transmission pilot wire.
- Industry approved by the latest new products of the 1978 I.E.E.E. Power and Communications Conference.
- Rated "suitable for use in the Bell System" by Bell.
- Meets I.E.E.E. standard 487-1980, all service types and classes.
- Standardized.
- Mountain Bell, New England Telephone, Bell Canada, Hydro-Quebec, Vermont Electric and many others.

The Telene Isolator is one of over 200 telephone and telecommunications products developed and manufactured by Positron since 1975.

POSITRON
U.S.: 184 North Main Street, Champlain, N.Y. 12919
Canada: 4810 Jean Talon West, Montreal, Que. H4P 2N5
Phone: (514) 731-3715. TELEX 05-825739

Job-matched canvas bags, pouches, buckets . . . tough, non-metallic. They feel right. They work right. Klein canvas goods for professionals at authorized Klein distributors in your area.



KLEIN
Hand me the Kleins
...since 1857.



Send for Catalog



Klein Tools, Inc. 7200 McCormick, Chicago, Ill. 60645

telephony

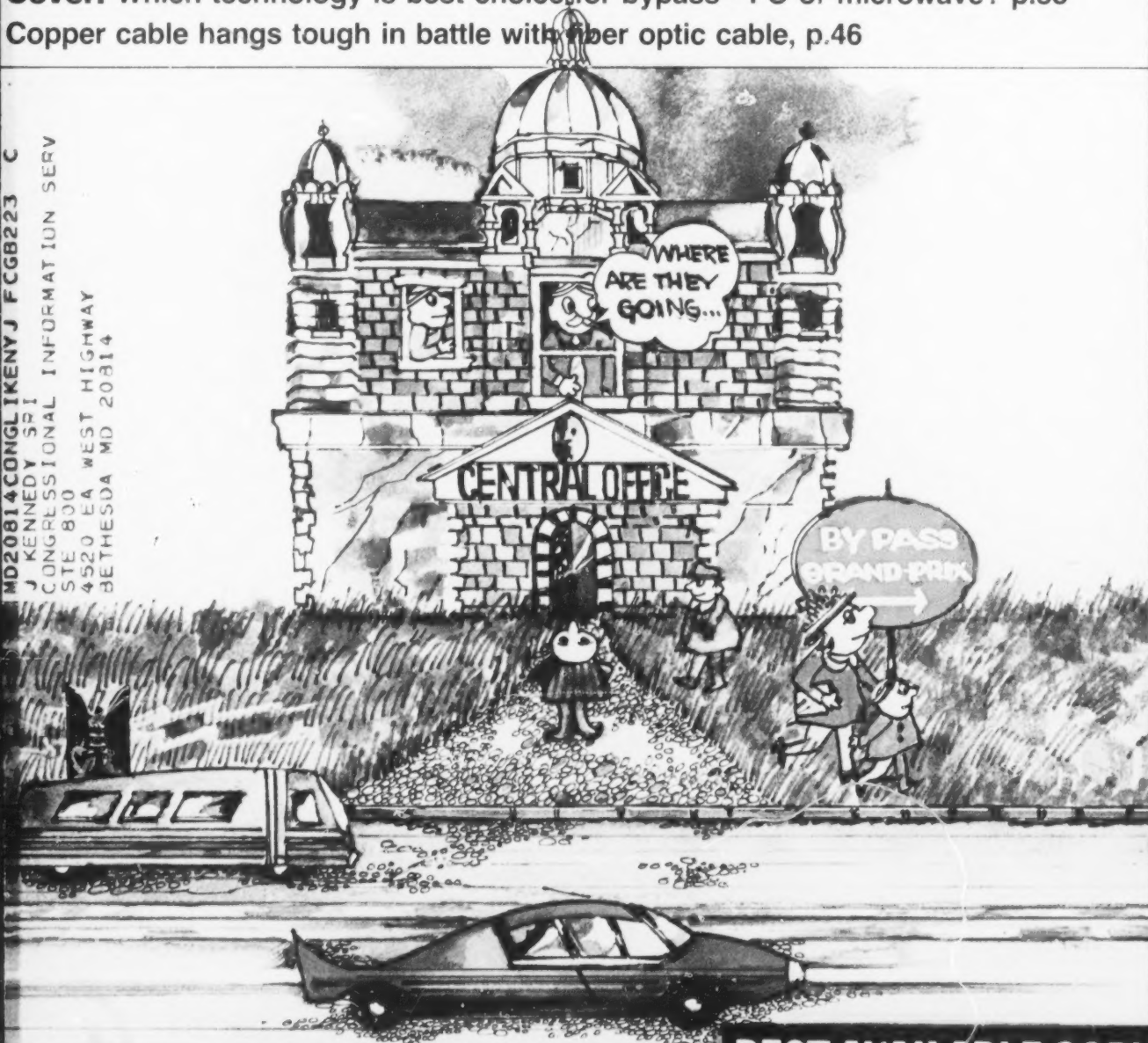
MAY 9, 1983

THE JOURNAL OF TELECOMMUNICATIONS SINCE 1901

TOP NEWS: Independents, BOCs form standards group, p.13
Harris plans to enter the cellular equipment market, p.13
FCC sets rulemaking for common carrier interconnections, p.16

Cover: Which technology is best choice for bypass—FO or microwave? p.38
Copper cable hangs tough in battle with fiber optic cable, p.46

MD20814 CONGL I KENYJ F CGB223 C
J KENNEDY SPI
CONGRESSIONAL INFORMATION SERV
STE 800
4520 EA WEST HIGHWAY
BETHESDA MD 20814



BEST AVAILABLE COPY

May 9, 1983

VOLUME 204
No. 19

telephony

News of the Week 13

Independents, BOCs plan telephone standards group • Harris plans to enter cellular market • American Bell unit picks regional site

46 Copper cable is alive and well

Copper cable still has a bright future, mainly because it already is in place, and has more bandwidth than normally used—and its capacity is expanding

M.C. Biskeborn

FCC proposes rules on interconnection details 16

In the Nation's Capital: FCC seeks comments on embedded CPE • Washington Round-Up

Victor Block

52 Early warning for telecom problems

An early warning system can alert telecom repair crews to equipment failures before customers lose service

Hugh M. Baker Jr.

Vexation and competition 35

As We See It: A temporary distinction between dominant and non-dominant carriers is necessary to ensure that users will eventually reap the full harvest of competition

60 Independents and the cellular market

Before joining the stampede to participate in offering cellular services, Independents must carefully weigh several factors

Lisa J. Stevenson

COVER STORY: Bypass choices 38

Microwave may be preferred for bypass over long distances, but fiber optics can be more cost-efficient over the short-haul

George M. Pfister

70 A power source for remote telecom systems

High reliability and simplicity make the closed cycle vapor turbogenerator the power choice of many telecom carriers

N.S. Christopher and J. Gropper

DEPARTMENTS

Advertisers' Index 110
Challenge and Response 112
Helpful Literature 91
In the Nation's Capital 16
Meetings 11

99 Moving Around Industry
82 New Products and Services
13 News of the Week
80 Plant Man's Notebook
9 Reader Service Card

Published by TELEPHONY PUBLISHING CORP.,
55 E. Jackson, Chicago, IL 60604
Telephone 312/922-2435; TWX 910 221 1058

European Bureau, 136 Broomfield Rd.,
Chelmsford, Essex CM1 1RN, England;
Telephone Chelmsford (0245) 58257;
Telex 995801 GLOTLX-G.

TELEPHONY (ISSN 0040-2656/83-0+\$1.50) is published weekly (except twice weekly during the second week of August and three times during the month of December) by Telephony Publishing Corp. Officers of Telephony Publishing Corp. are Dan S. Fargo, President; Leo Anderson, Executive Vice President; Del Myers, Ed Robinson and Robert Wehofer, Vice Presidents. Postmaster: Please send form 3579 to Subscription Dept., TELEPHONY, 55 E. Jackson Blvd., Chicago, IL 60604. Second class postage paid at Chicago, Ill., and at additional mailing offices. Single copies (payable in advance) U.S. \$3.00 ea., issues over 2 years old \$3.50 ea. Outside U.S. add \$1.00 ea. Subscriptions: \$29 one year. Outside U.S. add \$20 per year. Subscription rates apply to employees of operating telephone companies; telephone consultants; contractors; interconnect

companies; specialized common carriers; military government associations; private communications users; schools; libraries. All others \$35 one year. Outside U.S. add \$20 per year. Change of address: include old address as well as new address. Attach issue label if possible. Allow 4 weeks for change to become effective. Copyright 1983 by Telephony Publishing Corp. Permission to photocopy for internal or personal use or the internal or personal use of specific clients is granted by Telephony Publishing Corp. for libraries and other users registered with the Copyright Clearance Center (CCC) provided that the fee of \$1.50 per page is paid directly to CCC, 21 Congress St., Salem, MA 01970. Special requests should be addressed to Telephony Publishing Corp.

FO passes by microwave radio for shorter distance uses

Although microwave often is preferred for bypass over longer distances, this comparison of capacity, installation mode and distance reveals that fiber optics can be more cost-efficient over the short-haul

GEORGE M. PFISTER

DURING RECENT RESEARCH, a surprise emerged regarding the superiority of fiber optics (FO) to many other forms of bypass technology. This article compares fiber optics and microwave radio in the 12 GHz (gigahertz) and 18 GHz spectrums under a variety of traffic loading and implementation conditions.

There are three major factors which must be examined. These are distance, capacity and mode of fiber installation.

Fiber optics is distance-sensitive for both the cost of the cable and the cost of installation. Microwave is distance-independent and tends to be most cost-efficient at the utmost limit of its range. At shorter distances, fiber is frequently superior to 12 GHz and 18 GHz radio where circuit groups are large.

Relative to capacity, Perspective Telecommunications Group's research indicates that the usual bypass opportunity must qualify with a minimum of 24 circuits. It should be noted that the scenarios presented here deal with relatively large circuit groups. When fiber is compared to 12 GHz radio, each alternative will be configured in terms of multiplex equipment (which is the only vari-

able cost element per T1 channel) for 672 voice circuits. Similarly, the 18 GHz-fiber optic comparison will be made on the basis of 192 channels.

The most critical factor in comparing microwave and fiber optics is the circumstance of fiber optic installation. Fiber optic cable installed on an aerial basis on existing utility poles costs approximately \$5000 per mile to install, while buried cable in an urban environment can cost as much as \$50,000 to \$100,000 to install. Where fiber can be installed on an aerial basis, it usually will be superior to microwave. Where buried urban or conduit installation is required, the fiber approach only will be superior to 12 GHz radio in the two to five mile range, and always will be inferior to 18 GHz microwave.

While the expense of burying fiber optics at a cost of \$50,000 to \$100,000 per mile might be a formidable expense to justify, the recurring rental charges for conduit, which in some metropolitan areas run as high as \$25,000 per mile per year, would favor the heavy up-front costs for burial of private cable. It is important to examine the actual costs in each area for conduit rental versus burial of private cable, and to adjust the

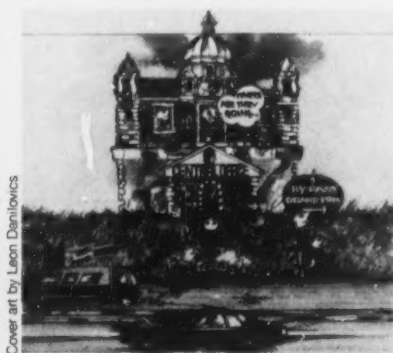
planning calculations according to the actual costs.

Another important consideration is that conduit space rental is not a regulated commodity; rates typically are based on supply and demand. As a result, conduit rental rates will be highest in the most congested areas. In congested areas, the cost of burying cable will come closer to \$100,000 per mile. Also, in highly congested areas it may be impossible to obtain the right to dig. In this case, conduit rental may be the only alternative.

In addition to distance, capacity and installation tradeoffs, there are several other factors that should be considered.

As opposed to 2 GHz, which is heavily used by communications carriers, microwave spectrum generally is available in the 12GHz, 18 GHz and 23 GHz bands, even in very congested areas. However, 12 GHz microwave is subject to pre-emption in 1988 by direct broadcast satellite (DBS) and, as such, this implementation could be viewed as short or medium term, about 5 years. The cost of licensing and route surveys is lower as the frequency increases beyond the traditional carrier, or most

George M. Pfister is President of Perspective Telecommunications Group, Paramus, N.J.



Cover art by Leon Denilovics

Today's telcos will have to adapt to withstand the challenge posed by competitive bypassers.

Table 1
Cost elements of private microwave links

	Operating frequency (GHz)			
	2	12	18	23
Tower (pair)	100	100		
RF + antenna	60	150	70	15
MUX (multiplex)	4	28	8	2
Installation and license	50	25	10	2
Total cost	214	303	88	19
Number of VFs				
Maximum	96	672	192	48
Average	90	300	120	40
Cost/VF	2229	450	458	395

popular, frequency bands (Table 1).

Negotiation of a right-of-way for a fiber optic cable can be relatively simple where only one municipality is involved. Where multiple municipalities are involved, microwave often becomes the automatic choice.

There are two things to remember about right-of-way problems. Many users assume they cannot obtain a right-of-way under any circumstances. However, they can obtain a right-of-way, although it may take as long as 18 months and some legal fees to get on the air.

Those users who can justify a fiber optic cable could simplify the right-of-way situation by working with Western Union, which has extensive right-of-ways in most metropolitan areas.

Also, the topography of the terrain around the user locations must be analyzed to ascertain whether a line of sight exists. In some cases a repeater must be installed for a microwave link, which increases costs to cover the expense of additional radios, multiplex equipment, towers and tower site leasing. Even where a reflector can be used, the substantial cost of a tower (\$50,000 to \$100,000) could still introduce prohibitive costs.

Weather can limit the range of microwave systems, particularly in the higher frequencies, limiting transmission span distances: 12 GHz microwave can operate out to 12 to 15 miles under most conditions; 18 GHz can operate out to 7 to 10 miles; and 23 GHz can operate over no more than 5 miles.

FO link cost factors

For this research, fiber optics is priced as follows for these subsystems: Cable cost is \$5000 per mile for a four-strand fiber (two used, two for protection). Each strand will cost \$1000 per mile, and \$1000 is allocated to package the strands, yielding the total cost of \$5000 per mile. The transmitter cost is \$28,000 for both ends of the cable run. The multiplex equipment cost is \$1000 per T1 channel, which is identical to the cost for microwave multiplex circuitry. The installation cost will vary depending on the installation situation: aerial installation will be \$5000 per mile; conduit will be \$5000 to \$10,000 per mile; buried (rural or suburban) will be \$10,000 to \$15,000 per mile; and buried urban will be \$50,000 to \$100,000 per mile.

Note that the installation of a six-

strand system would add an additional \$2000 per mile and would double the capacity of the fiber cable.

In this comparison the fiber is to be operated at the DS-3 rate of 44
Continued on page 42

Table 2
Aerial installed fiber optics

	Distance (miles)			
	2	5	10	15
Cable cost = \$5000/mile	\$10,000	\$25,000	\$50,000	\$75,000
Multiplex equipment = \$1000/T1	\$28,000	\$28,000	\$28,000	\$28,000
Transmitter	\$28,000	\$28,000	\$28,000	\$28,000
Installation = \$5000/mile	\$10,000	\$25,000	\$50,000	\$75,000
Total cost	\$68,000	\$86,000	\$116,000	\$146,000
Cost/VF fiber (672 VFs)	\$101	\$128	\$173	\$217
12 GHz microwave (672 VFs)				
Total cost	\$303,000	\$303,000	\$303,000	\$303,000
Cost/VF	\$450	\$450	\$450	\$450
18 GHz microwave (192 VFs)				
Total cost	\$88,000	\$88,000	\$88,000	
Cost/VF	\$458	\$458	\$458	
Fiber (192 VFs) ^a				
Total cost	\$48,000	\$66,000	\$96,000	
Cost/VF	\$250	\$343	\$500	

a. Cost for cable, installation and 8 T1 multiplexers

Table 3
Conduit installed fiber optics

	Distance (miles)			
	2	5	10	15
Cable cost = \$5,000/mile	\$ 10,000	\$ 25,000	\$ 50,000	\$ 75,000
Multiplex equipment = \$1,000/T1	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000
Transmitter	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000
Installation = \$30,000/mile	\$ 60,000	\$150,000	\$300,000	\$450,000
Additional 4 year conduit rental @ \$25,000/year	\$100,000	\$100,000	\$100,000	\$100,000
Total cost	\$226,000	\$331,000	\$506,000	\$681,000
Cost/VF fiber (672 VFs)	\$ 336	\$ 492	\$ 752	\$1013
12 GHz microwave (672 VFs)				
Total cost	\$303,000	\$303,000	\$303,000	\$303,000
Cost/VF	\$ 450	\$ 450	\$ 450	\$ 450
18 GHz microwave (192 VFs)				
Total cost	\$ 88,000	\$ 88,000	\$ 88,000	
Cost/VF	\$ 458	\$ 458	\$ 458	
Fiber (192 VFs) ^a				
Total cost	\$206,000	\$301,000	\$486,000	
Cost/VF	\$1073	\$1567	\$2531	

a. Cost for cable, installation and 8 T1 multiplexers

megabits per second (Mbps), and state of the art systems operate at the DS-3C rate of 90 Mbps. Thus, the fiber optic system would have twice the capacity of a 12 GHz microwave.

Aerial installed FO

As shown in Table 2 aerial installed fiber optics is always superior to 12 GHz radio, and is competitive with 18 GHz radio out to ranges where the performance of this radio frequency becomes suspect.

Rental rates for pole space are reasonable, typically about \$1 to \$2 per pole, per year. The one-time installation cost of \$5000 per mile includes these pole rental charges for a 5-year period.

Conduit installed FO

Renting conduit from a local utility allows the user to install a fiber optic cable for approximately \$5000 per mile. The cost of installing cable in an existing conduit is comparable to the cost of aerially installed cable, but the rental for the conduit space can be as high as \$25,000. As noted in Table 3, an additional cost of \$100,000 is included in the fiber optic cost to account for 4 additional years of conduit rental. This annual rental of \$25,000 represents an extremely high rate and is used conservatively. In this case, as outlined in Table 3, the fiber optic cable is superior to 12 GHz microwave out to approximately 5 miles. The 18 GHz microwave is always more cost-effective.

Buried urban FO

In the buried urban environment, costs are high because of increased labor costs when pavement must be dug up and restored. In some metropolitan areas the estimated cost of \$50,000 per mile could be conservative, \$100,000 per mile may be more realistic.

As Table 4 indicates, fiber optics is never superior to 18 GHz radio. Fiber optics' cost advantage over 12 GHz radio disappears where distance exceeds approximately 4.5 miles.

At extended ranges, the distance-independent nature of microwave tends to increase the applicability of this mode of operation. Also, as distance increases to the longer ranges of microwave, the increased probability of having to deal with multiple municipalities for fiber optic right-of-way can introduce difficulties that would make microwave the preferred approach from the outset.

Table 4
Buried urban fiber optics

	Distance (miles)			
	2	5	10	15
Buried urban				
Cable cost = \$5000/mile	\$ 10,000	\$ 25,000	\$ 50,000	\$ 75,000
Multiplex equipment = \$1000/T1	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000
Transmitter	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000
Installation = \$50,000/mile	\$100,000	\$250,000	\$500,000	\$750,000
Total cost	\$166,000	\$331,000	\$606,000	\$1,616,000
Cost/VF fiber (672 VFs)	\$ 247	\$ 492	\$ 901	\$2404
12 GHz microwave (672 VFs)				
Total cost	\$303,000	\$303,000	\$303,000	\$303,000
Cost/VF	\$ 450	\$ 450	\$ 450	\$ 450
18 GHz microwave (192 VFs)				
Total cost	\$ 88,000	\$ 88,000	\$ 88,000	
Cost/VF	\$ 458	\$ 458	\$ 458	
Fiber (192/VFs)^a				
Total cost	\$146,000	\$311,000	\$586,000	
Cost/VF	\$ 760	\$1619	\$3052	

^a. Cost for cable, installation and 3 T1 Multiplexers

Fiber optic cable is the preferred approach for very high capacity links because it has twice the circuit capacity of 12 GHz radio if implemented on a DS-3C (90 Mbps) signaling rate. Comparing fiber and 18 GHz radio, the capacity advantage of the fiber is even more impressive, offering 672 voice frequencies (VFs), compared to 192 VFs at DS-3 rates.

As can be seen in Table 5, the aerial installed fiber optics is superior to 18 GHz microwave out to 8 or 9 miles, at which point the consistent performance of the radio approach under adverse weather conditions could be suspect. However, where buried urban or conduit installation is required for a fiber link, it will be one and one-half to six times as expensive as 18 GHz radio.

All of the alternatives presented

here assume complete loading of either the fiber or microwave systems, and it is likely that few users can anticipate bypass or private networks which require 192 or 672 voice circuits.

One might ask whether this analysis is an academic exercise.

The answer is that high levels of capacity can be required for several reasons.

The requirements for high-speed data channels operating at T1 rates of 1.544 Mbps or higher could have significant impact by absorbing channels on the lower capacity 18 GHz microwave.

Also, some users are implementing or planning short-haul video teleconferencing systems. While great strides are being made for compres-

Continued on page 45

Table 5
Fiber optics vs. 18 GHz microwave

18 GHz radio	\$ 458	\$ 458	\$ 458
Aerial fiber	\$ 250	\$ 343	\$ 500
Conduit fiber	\$1073	\$1567	\$2531
Buried urban fiber	\$ 760	\$1619	\$3052

ANOTHER YOUNG UPSTART! With: Better Design - Better Price



FIELD PROVEN

A million now in use by major operating companies.



PROTO-TEL'S 25 PAIR CONNECTOR COVER

- ✓ SCREWS and KNOCKOUTS for mounting over wall outlets.
- ✓ ADHESIVE SNAP-ONS for wood desks, concrete, etc.
- ✓ CAPSULE LIKE for scrub water protection on floors.
- ✓ ADAPTS TO MODULAR with exterior plug-in to modular jacks.
- ✓ MAGNETS (optional) for metal desks.

P.O. Box 1052 Boulder, Colorado 80306 (303) 444-0971

Check No. 17 on Reader Service Card

Target ~~11,400~~ 12,550
International Sales
Prospects
By Using

**Telephony's International
Postcard Mailer!**

That's how many telecommunications specifiers and buyers outside the USA will receive this packet.

Yes, to help you reach a larger share of the international telecommunications market directly and economically during World Communications Year, we are increasing distribution by 10% and the cost is still \$510. If you are interested, fill in the information below and send this ad to Rita Bross at Telephony.

Closing date for the August 1983 mailer is July 1.

NAME: _____
COMPANY: _____
MAILING ADDRESS: _____
TELEPHONE: _____

TELEX: _____

telephony
International
55 E. Jackson Blvd.
Chicago, IL 60604
(312) 922-2435
TWX 910-221-1058

Check No. 18 on Reader Service Card

sion of digital video into the 1.544 Mbps range, video codecs operating at 3.0 or 6.0 Mbps transmission rates may be required which would have severe impact on an 18 GHz microwave system.

An additional capacity consideration in favor of fiber optics is raised by the possible resale of bandwidth to another user whose route is complementary to the one being contemplated.

Also, remember that the typical bypass requirement will be in the 24 to 48 circuit range which can be adequately handled by 23 GHz microwave systems, such as General Electric's Gemlink. At a total cost of \$19,000, these systems will be very attractive where the 5 mile distance constraint is not an issue.

Users who are contemplating a private network to support requirements which exceed the current capabilities of the telco twisted pair plant, such as 56 kilobits per second (kbps) or 1.544 Mbps rates should also be patient. Technologies such as terrestrial data circuits (TDC), effectively a T1 carrier, and circuit switched digital capability (CSDC), which allows alternate 64 kbps pulse code modulation (PCM) voice or 56 kbps data, will be appearing in the next few years. Therefore, a private network justified because of the unavailability of broadband data might be suspect with these new services in the offing.

Further, it is estimated that 5% of the existing local access plant is being upgraded to digital T1 based technology on an annual basis. One major communications manufacturer suggests that 40% of many major metropolitan areas are already wired this way. As a result, derivation of TDC and CSDC channels can be expected to alleviate today's bottlenecks in about 5 years.

As a result of competition and digital plant, it is expected that costs for broadband digital circuits will decrease dramatically in the years ahead.

Also, while few users can justify communications links with 192 to 672 voice channels, the local telco frequently can justify such links. The local telcos can be expected to make maximum use of fiber optics, and they own conduit and right-of-ways—the infrastructure to support broadband services at cost-effective rates. In other words, current deficiencies in service availability should not be assumed for the long term. □